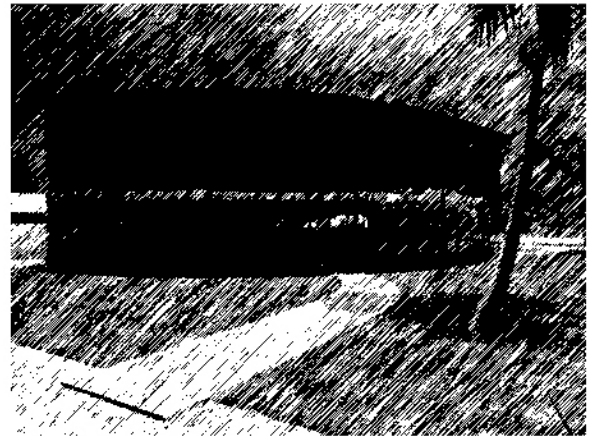
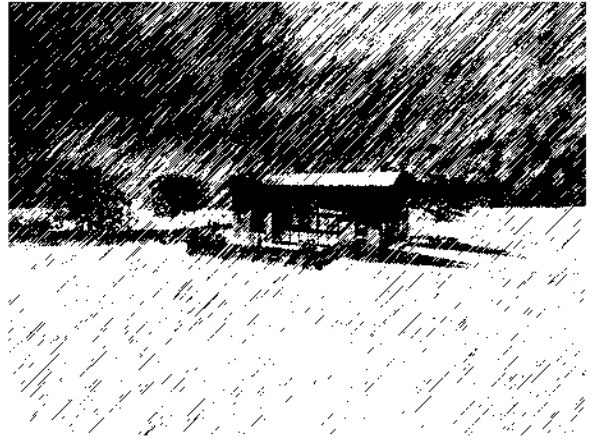


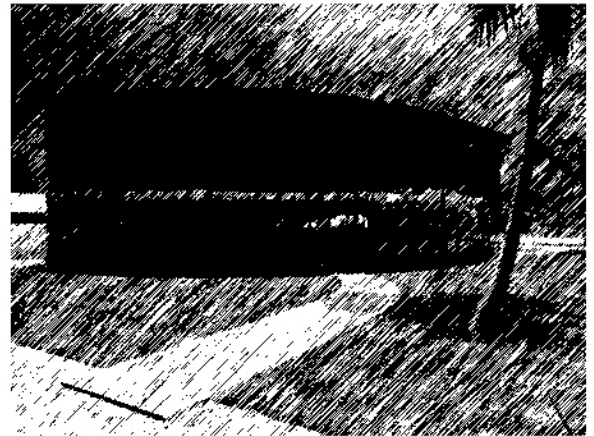
Adaptive Design: Designing for Disaster



Architecture Thesis
Matt Van Wienen, Spring 2006



Adaptive Design: Designing for Disaster



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Abstract

Contained in this book is the Adaptive Design Thesis. In this book you will find the thoughts that created the idea for the projects, the process of the design, and the final solutions to the thesis.

This book is sectioned into three parts. The first part of this book is the ideas and concepts behind the selection of the projects and the assumptions behind them. In the first part of this book it informs the reader that the problem to be dealt with is natural conditions that people in these areas generally do not take into count when they build. Basically it talks about how the natural elements of an area or areas need to be taken into account when a site is selected and a building is constructed. It also tells how Indiana river flooding, Florida hurricanes, and New Orleans levees breaking were selected.

The second part of this book is the design concept, process, and final design. This section is broken into three parts. Each of these parts deals with a specific site and area. Within each of these projects it is further broken down into specific solutions. The Indiana solution is moving up, the Florida solution is closing up, and the New Orleans solution is lifting up. Inside each section explains how each site was selected and the process that led me to the final design.

The final part of this book is the conclusions section. This part of the book describes the final solutions and there applications. Which in this section is just a condensed version of all the projects to reiterate the final solutions which. The solutions are "Move up, Close up, Lift up". This section also contains the bibliography.

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The Beginning

One evening over the summer of 2005 just before the 2005-2006 fall semester started I was watching television. The channel just happened to be the discovery channel and the program happened to be on how the Dutch had build levees and reclaimed land. I watched this show from beginning to end. Why did I watch this show, because I had nothing better to do at that time. But, that show intrigued me, and started me on the journey to creating the basic idea for this thesis.

After stewing on what that show had informed me with, I began to think about how water and weather affected our country. From there I started to look at some of the problems we commonly had with homes being destroyed by water and wind. I then discovered that the places that were commonly having trouble were not one time occurrences. It seemed that in certain areas of our country these places were getting destroyed constantly and about the same times every year.

From that discovery I started to think, why a person would live in an area that is known to have water trouble or weather trouble. To go further into that thought if this is know it is logical to not live in those areas. But, people in general are not logical and that is why when something occurs there are always people on the television wondering why there homes are destroyed. From that line of thought I started to look at those areas. From that thought process I determined that people live in those areas because of culture, scenery, seclusion, and recreational aspects.

But to me, if a person is going to live in an area such as this why that person doesn't have there building designed to withstand the conditions that are known to be present. This particular idea is what I chose to do with my thesis. I choose to take these areas that are known to have reoccurring natural problems and design buildings that will function with the impending problems.

River Flooding Scenario

At first I was only going to try to create a single family residence that would deal with river flooding. In this scenario I choose a site that was close to home so that I would have access to the site. I choose a site in Indiana in the Lacrosse area. This site was known to flood every spring as the winter snow melted. I discovered that this was caused by the narrowing of the Kankakee River at the Illinois Indiana border. At that point, the river narrows, which then causes the water to rise because of constricted flow and thence, is causing the entire river to flood.

I then started to design a building to fit that scenario and began to do research on what had previously been done to deal with a situation such as this. I found books and other resources on this issue and did some analysis on them. The analysis is in the following section call President Studies.

President Studies

Bridge port Connecticut:

This design study uses a raised platform w/ parking underneath. It uses townhouses as a design w/ a raised deck platform. This platform is supposed to support social interaction between the units. There is a ramp that is provided for the handy cap to access the site and in the event of emergencies it can be used to drive vehicles up to the houses themselves.

It is orientated in a square type of shape and it is made of units that are similar to each other and they are staggered to create some visual interest. The underbelly of the structure looks as if it is all made for function purposes only. I say this because it is made to house utility shafts and cars. There is nothing of any real interest that goes on in this space. Therefore it is not a very interactive space.

Looking at the cross section of the plan it uses concrete piers to help elevate the area and uses steel joists to support the floor decking itself. It has a double-layered floor decking that helps with insulating the floor from winds and weather. Doing it with this type of construction is useful in running utilities to various places in the structure and it helps by making repairing these systems fairly easy. It uses a stair tower to gain access to the units themselves. And or one can drive up to the front of the complex via the ramp that is provided and drop off items there and then park in the undercarriage of the structure.

There are no real plans of the individual units so to determine what is going inside is difficult. From the section it looks as if it is a standard townhouse with the living room kitchen and dining area on the first level and the bedrooms and bathroom on the second floor.

Charlestown and Newport, Rhode Island:

These are two different locations that were chosen to study. They were chosen for their differences in culture and natural conditions that would affect flood design. Newport is a community that has mostly recreational aspects and many homes near the waterfront along w/ a protected harbor. Charlestown is a mainly residential area with lots of beachfront property. Both of these locations have a very strong context to deal with and in order to design in them that context has to be considered. If the context were not considered than any radical change in building type would be a visually distracting element that may not work with the communities.

Charlestown:

The method of building here was determined to be by bringing in fill to bring the ground level up to the appropriate height in the flood plan. It was also determined to make the building area dense due to the cost of bringing fill in and the amount of area that could be used. The building type itself was designated as single family housing to fit in with the aesthetic of the area and all the utilities were placed in the core of the fill to keep them protected. Parking and park areas were left in the flood plane area.

Newport:

A combination of raised platforms and berms were used to bring the level up to what it needed to be. This created the opportunity to use the different levels to integrate how the utilities were run and how the views could be captured.

Analysis:

The use of earth fill is a viable alternative to an elevated platform but to me it is more of evading the problem. Trying to find enough suitable fill for a large-scale project would become a problem as well as what the impact on the natural eco system of that area.

The parking of this plan is still in the flood plan and is located in front of the buildings themselves that are raised up. Each area seems to have its own little front yard and back yard but it seems small. The parks are located along with the cars in the lower area. The reasoning for this I would think is that the objects in these areas are considered to be expendable especially a park that would be of a minimal concern.

The form of the plan is an individual unit that is square and staggered to try to create more sense of privacy. To me the layout works if it were meant to be an apartment complex but could be improved on. The aesthetic of the area is interesting with the boardwalk that circles around the development at a level that is higher than the parking but lower than the buildings. The use of stonewalls also creates an interesting effect about the design and gives it a sense of order. The problem is that it looks like a big massive complex that is standoffish to people to people that would cause them to want to leave and or not be around this place.

The use of fill and elevation gives a more intricate and inviting environment to work with but still has the same issue of area of fill and how much is too much and what happens to the natural scheme of things.

By using the berms and raised structures together it provides different opportunities to give people different views and in the same token it can give everyone a view. It can create the multi levels of living and give interest and excitement to the living community. But where does everyone park and how do they get all of their possessions into their own spaces. What happens to the age of this community? I think that the idea of what is being done is very plausible but how it functions is another thing. Over time when people age this type of a facility and or community would not work for them. There would be too many stairs and elevations changes for older people to deal with let alone any handicap people it would be uninviting to them because they could not navigate the area also it would not be very effective for emergency vehicles they have no way to get to the buildings to help stop fires and or get to people with speed if needed.

Also the use of so much fill would be questionable. Question one would be where do you get that much clean fill and question number two is how do you make it buildable.

San Francisco:

Single family residences: This study uses different types of visual breaks to help hide the fact the buildings are elevated. And as per the other studies there is parking and service areas in the space that is elevated. The difference with this project is that it has a bunker/ vault that houses the utilities so that they do not get damaged when the flooding happens. And as per the other ones it puts the service ducts and utilities in the ceilings so that they are at the highest part so the water does not damage them. Also the structure is as the others using a wood post framing system that goes in both directions so that the structure can handle the added movement that will be put on them. Perhaps this can explain why most of the designs are all square and unexciting or interactive in my opinion.

The section of this type is the same as the others it has boxes that hold space and boxes underneath for parking and storage and other type activities which seems to be ok but does it really get used or is it really just a waste of time to even think of that way unless it is designed to be interacted. This design in general is pretty dry just like the two before this.

Multi-Family residential concept: this structure is conventional wood construction on a wood platform. It uses fencing and open stairs to help hide the fact that it is elevated. This concept is mainly developed to try to hide the fact that it is a building that is elevated.

There really isn't much difference between the single family and multi family buildings in this design area. They use the same framing and structure but they do have different designs in the fact that one uses fencing to contain and hide space and the other uses trellis work and other conventions to wrap around the building to just hide the fact that it is elevated. But why do you have to try to hide the fact that it is elevated this is a question that I need to answer because I see no problem with showing that the building is elevated. I think that it should be expressed.

Chicago Illinois:

This area deals with the Midwest flood types, which is ravine flooding and lake flooding. This building is brick and block and was designed on a garden type apartment. It like the other uses the main level as parking but the difference is it has an enclosed stair tower to get the townhouse units. It for once doesn't try to hide the

fact that it is elevated by covering it up it just fills in the wholes to make it look like it uses all three levels.

To me this is more engaging of the area and less obstructive than the others.

The Logan House

This building is elevated like the rest but it is raised higher than is required. It is built in the dogtrot style. It was raised higher so like the others the lower level could be used as parking but it also has usable outdoor living areas down there. These are different from the other because the others only addressed the parking issues and maybe play space not and outdoors living space. This structure also has a breeze way that is open but has a roof which is different and this porch are breeze way works with the floor structure to help create a diaphragm to help strengthen the structure. Which the structure itself is made of pine, which is odd because pine is a soft wood and prone to warping. This house also uses passive cooling, which is aided by the structure being elevated so that it can draw the cooler air up from underneath unlike conventional buildings. To help the passive cooling this building has a clear story with operable windows to help pull air through the building itself.

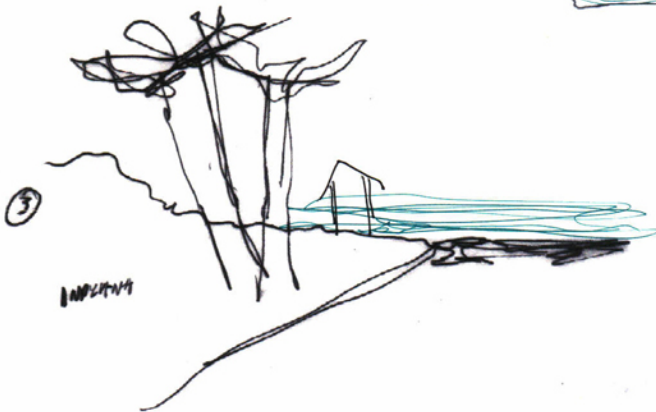
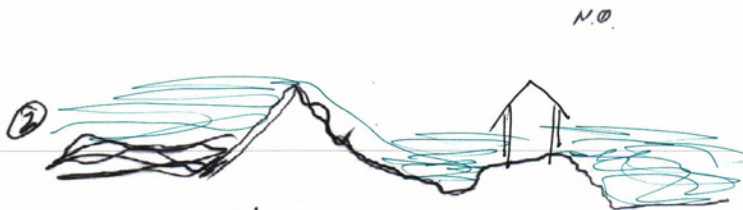
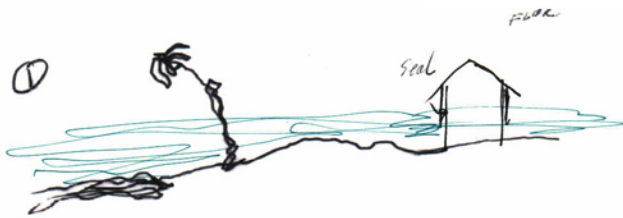
The plan of this building is very basic there is a main core of the house, which consists of the living, dining, and kitchen areas of the building and to the north it has the bedrooms and bathrooms and to the south it has other service rooms. Over all the shape of this building is more like a pyramid with a hat on it and it has a few different levels of decking. The different levels of decking to me seem to suggest that there can be different experiences that could happen when the flooding could occur. This is a start to the approach that I am trying to take. The interior of the space is very modern so the exposed rafters and open concept would apply to more of a contemporary outlook.

Scenario Analysis

From these presidents I then went back and thought about what I wanted to do for the thesis. After conversations with different professors and students I then went and chose three different scenarios. These scenarios were river flooding, as I had originally planned, Hurricane conditions, and levee breaking. These last two scenarios were added to the thesis because of hurricane Katrina.

With these three scenarios selected I then started to do some analysis on the three conditions to determine what type of reaction would best suit each place. This was accomplished by creating simple concept studies of different ideas in each of these scenarios. I created a simple section that displayed all three scenarios and then put ideas on each one to see which idea would work best for which scenario.

These drawings are organized so that the hurricane concept is first, then the levee breaking was second, and finally the river flooding concept.

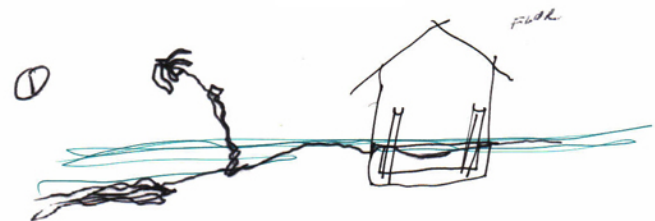
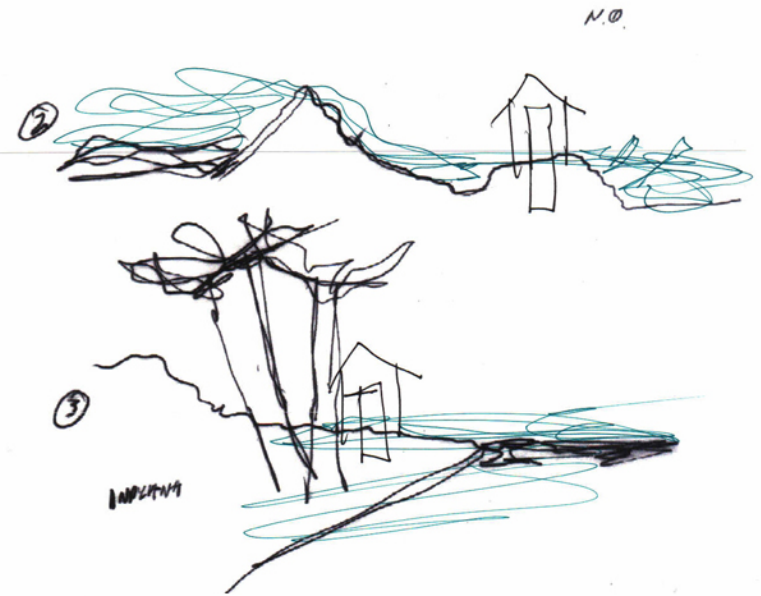
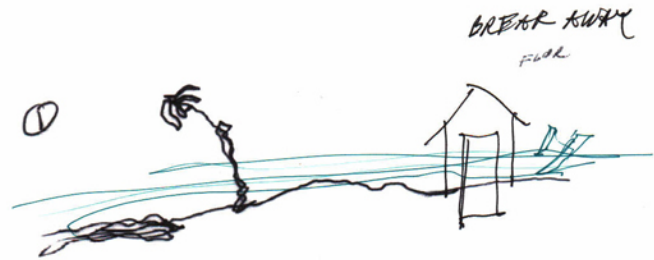


The Barricade

The initial idea behind this concept was that when trouble was near or forecast that the building would have some sort of device that would seal up the building.

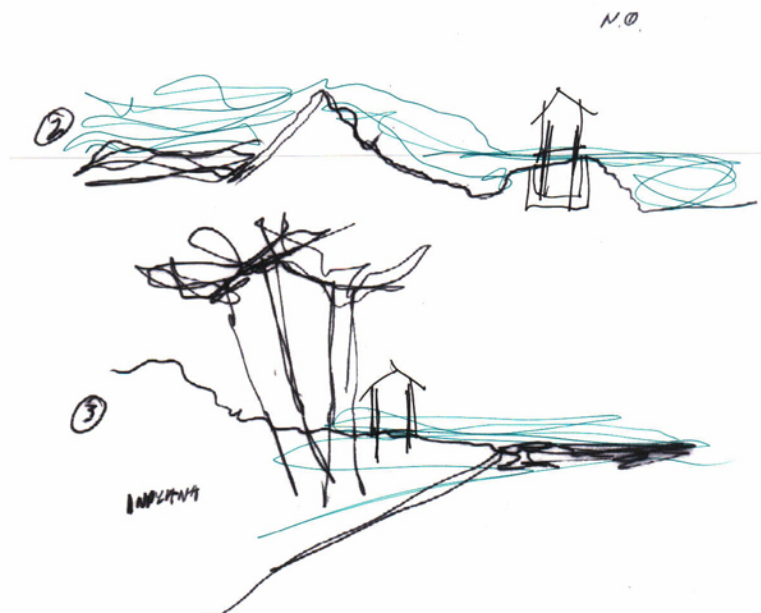
Break Away

The idea behind this concept was that the house was designed around a core. Within that core the occupants would place all their valuables and items that they did not want damaged in this area. Then this area of the building would be sealed and the rest of the building around this core would be able to be damaged and or taken away by the natural forces that may be there. Leaving the core in tact and water free.



Duck

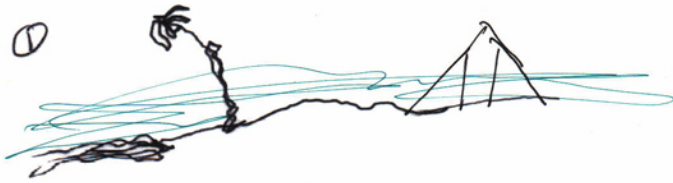
This concept was to create a building that could move along with whatever water level was present. This would be accomplished by creating a basin for the house to set on and when the water came through it would fill the basin first and then the building would float on the water keeping its contents high and dry.



FORTRESS

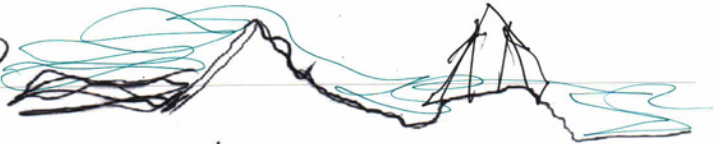
Fish

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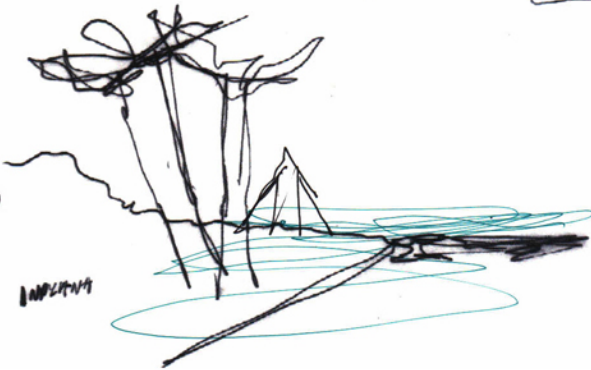


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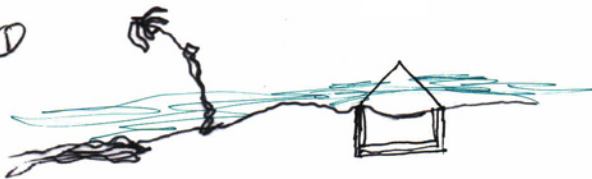
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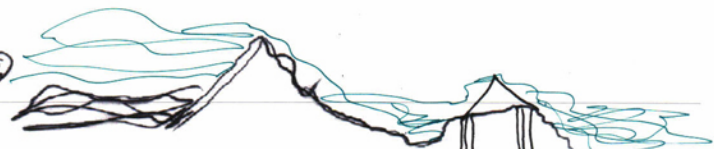
Fish

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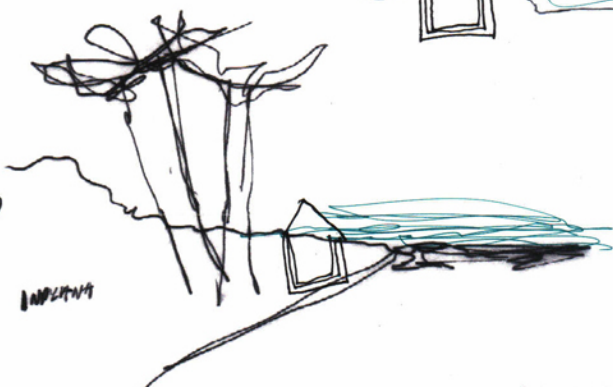


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The Fortress

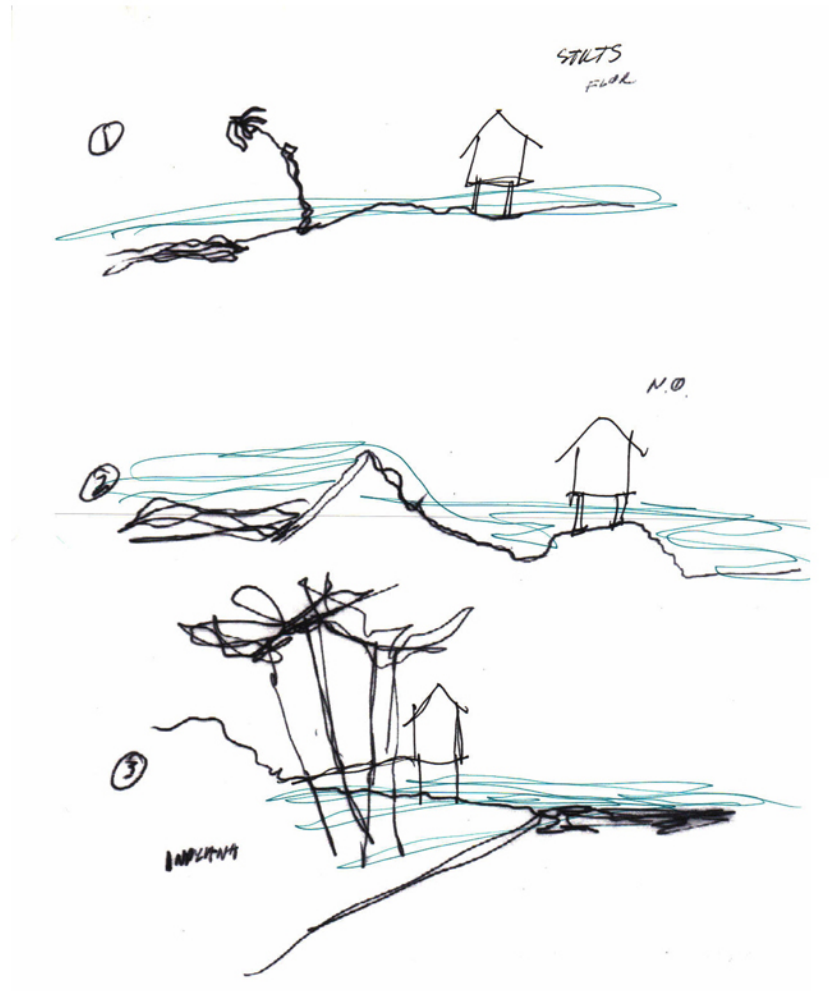
This concept was designed to have a system in the building that would completely enclose the building during disastrous weather to give it a second skin of protection.

The Hat

This concept was created to see if a building could be lowered into a bunker type space. The space itself would be large enough for the building to be lowered into and the roof structure would then be created out of a water tight material. When the building was lowered into the bunker the roof structure would then become the top part of the bunker and seal the building from the elements.

Stilts

This idea is not original and conforms to the president studies from the previous section. This concept basically raises the building off the ground to a predetermined elevation to keep the building and its occupants out of harms way.



PRO CONCEPTS	CON	
1. foldable for sealing a. good for quick in & out c. MINIMIZE DAMAGE	a. Depo. furnishings b. TIME WAST c. PUT UP + TAKE DOWN.	+
2. a HANDLE flash flood	a. would fill up b. sustained WATER could fail	+ -
3.	a. seasons could Break down seals or MAKE JOINTS STICK b. WATER could get in and freeze + cause damage to joints. c. could fail under long exposure.	-
Footprint		
1. floats 2. No remaining things	a. WIND Problem utilities b. Anchoring Problem c. WAVE Problem d. WATER LEAK e. Flying Debris.	-
2. a floats b. Anchoring c. Less wind shifting d. No waves e. can adjust easily	a. Anchoring b. POSSIBLE Debris c. Utilities.	+
3. adjust easily a. Wind not a problem c. slow movement d. no waves. e. can be sustained + used	a. utilities b. access.	+
Hill side		
1. more water comes in to it	a. utilities. b. To much force can destroy it. c. waves could destroy it. d. erosion e. foundation Problems.	-
2. moves.	a. erosion b. lot size c. sinking d. no firm foundation	-

Concept Selection

After creating the different scenarios from the previous pages I then created a matrix to see what the pro's and con's were for each concept. In this matrix I determined if that particular concept would work and for which area it would work for. From that point I then selected three of the concepts.

River Flooding Concept

For the river flooding concept I selected the age old idea of putting a building up on stilts. I choose this one for this area because of the conditions that surrounded the natural forces. In this type of scenario the main components to deal with are heavy rain and rising water. Due to these components it made this idea the most economical choice because it required no moving parts and is a proven system in these conditions.

Hurricane Concept

For this concept I chose the fortress concept. This was selected as before due to the conditions of the scenario. In this concept the main focuses are wind, flying debris, and driving rain. With this concept it seemed to make sense to create a secondary barrier to protect the actual structure itself.

Levee Breaking

In this scenario I chose to use the duck concept. This was chosen as the other two were due to natural conditions of the scenario. The conditions to be dealt with are rising water, wind, and context. In this concept it seemed to make sense to create a structure that would adapt to the conditions that surrounded it in a manner to protect the occupants of the building.

<p>Hill</p> <p>2. a. Slide up Natural Hill b. Seasonal c.</p>	<p>A. Breeze & Flow.</p>	+
<p>1. <u>Boomed</u> a. Raised above level b. No utility problem c. Water</p>	<p>a. WATER HEIGHT problem b. Wind c. Debris</p>	+
<p>2. NO WATER PROB</p>	<p>a. WATER HEIGHT b. aesthetic. c. Foundation.</p>	+ -
<p>3. <u>WATER HEIGHT</u> NOT A problem a. NO problem. c. Seasonal NO problem.</p>	<p>a. access b. Look c. Height.</p>	+
<p>1. <u>Barricade</u> 1. Debris minimized 2. solid structure 3. WATER TIGHT</p>	<p>A. seals fail B. IMPACT RATING. C. JOINTS. d. Quality of construction</p>	+
<p>2. <u>WATER TIGHT.</u></p>	<p>A. TIME B. WATER HEIGHT C. ACCESS.</p>	+ +
<p>3. <u>WATER TIGHT.</u></p>	<p>A. TIME B. WATER HEIGHT C. ACCESS.</p>	+ +
<p><u>MAT.</u> 1. a. MIN DAMAGE b. NO LOSS OF STUFF. c. NO MOVING</p>	<p>a. seals b. Root Strength c. MATERIAL</p>	+
<p>2. "</p>	<p>A. TIME B. AS ABOVE</p>	+ -
<p>3. "</p>	<p>A. AS NOTED ABOVE,</p>	-

The Next Step

After these three concepts were selected I then went into the designing of the three projects. The first project was in Indiana, the second in Florida, and the third in New Orleans. The following section will describe the process of each concept and the final design.

Indiana “Moving UP”

Site Characteristics

It has an area that is burned up in the east that is directly adjacent to the canal with a path that follows the canal. This site is about six archers and has various buildings on it. These buildings consist of a house, garage, chicken coops, and various sheds on the property. The area that is heavily wooded is at the lowest elevation on the site and floods first. As the water raises it fills up the east and south portions of the site first. The area where the house sits is up about 8 feet from the southeast side of the site and generally doesn't get touched by the water except in very wet years.

There are random piles of soil on the south side of the property that have no apparent purpose that I could evaluate. Also on this site are various pieces of old farm equipment and things of that nature.



Aerial Photo

Site Analysis

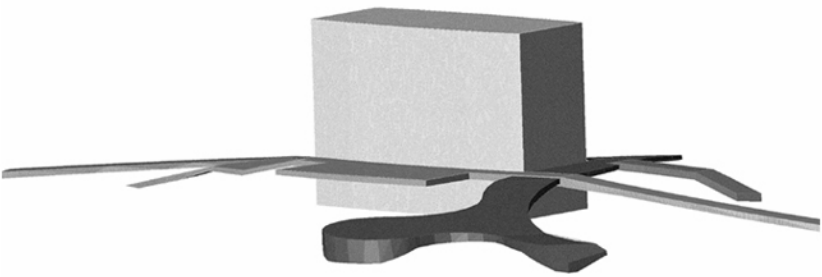
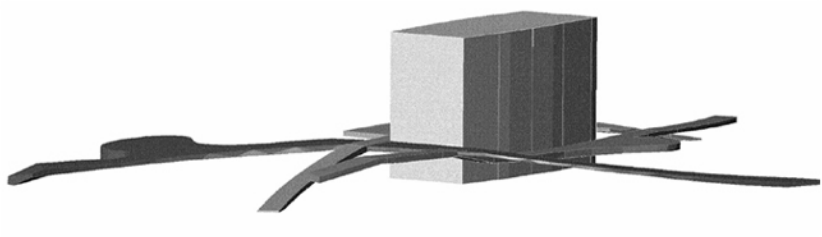
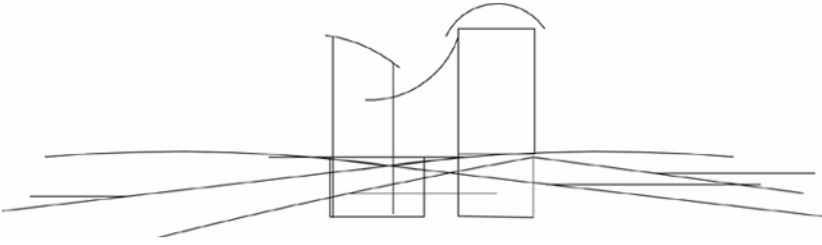
This site is in a low laying area just north of the Kankakee River in Indiana. The north south road on this site is highway 421 and is elevated about ten feet above the site itself. The site itself is in a depressed area that borders drainage canal off of the river itself. This area floods every year during extended rain periods and when the snow melts.

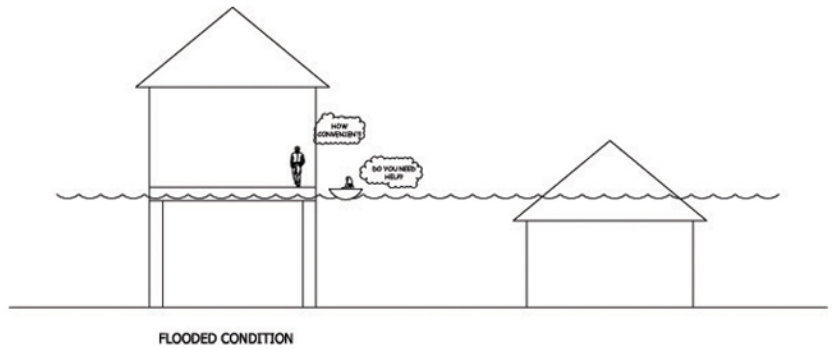
Analysis Diagram: This diagram was noted to show specific areas of the site that have different changes that can not be seen from a top view.



Concept

A ramping system concept was chosen to try to mask the height of the building. The purpose of these ramps would be to create different experiences at different levels of flooding. There were to be different balcony and decks throughout the system at different levels. This was to give the occupants different options for them to view the area during times of flooding. In a sense to try to make the times of flooding something to look forward to so that it changed the view.

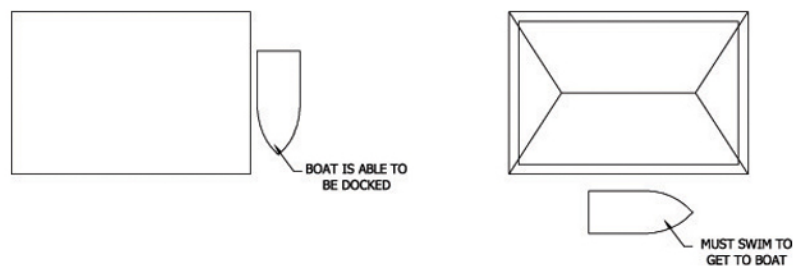




Moving Up

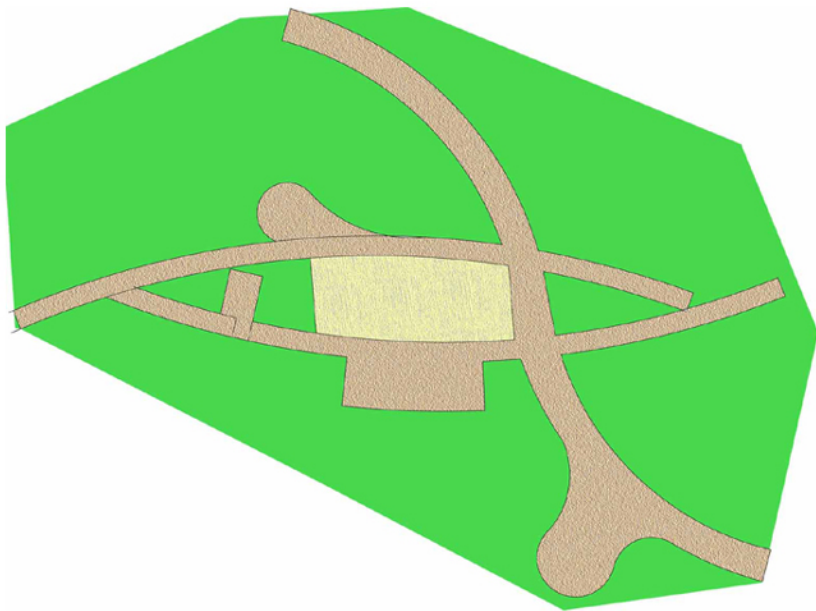
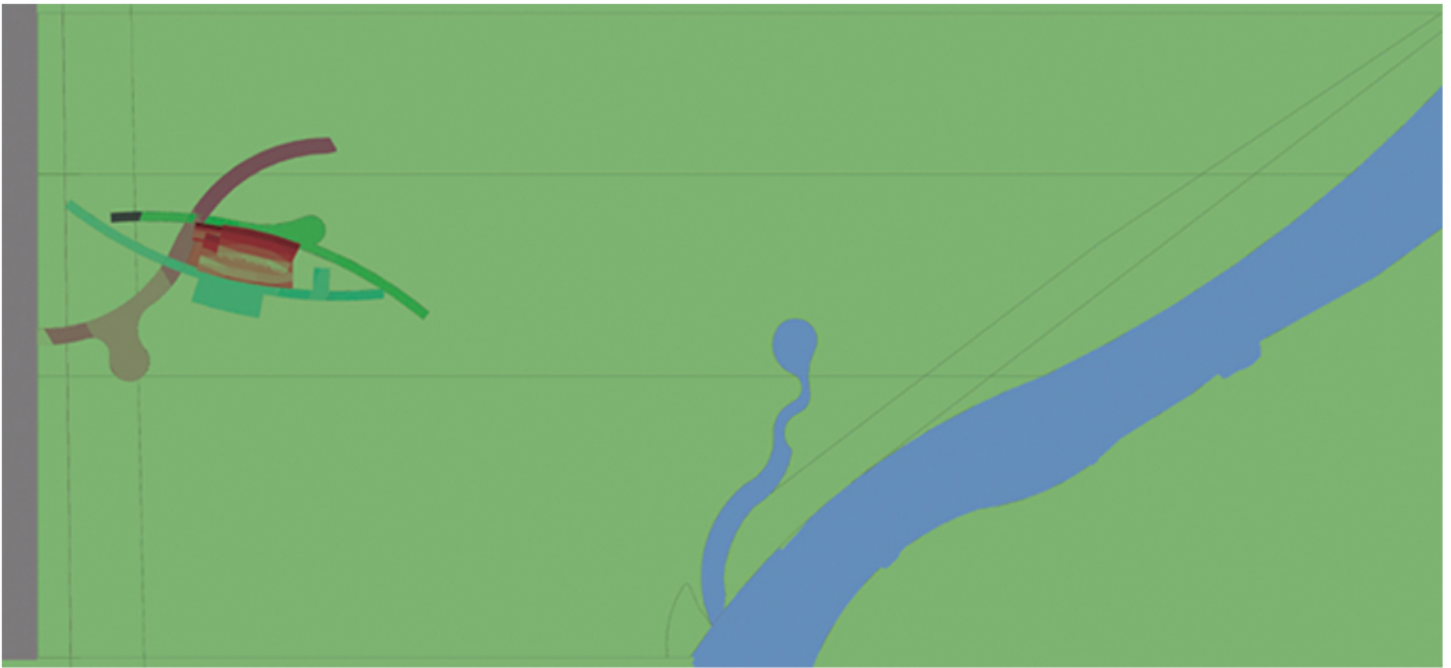
The idea of putting a building up on stilts is not a new idea. This has been practiced for hundreds of years by many different cultures to try to deal with rising flood waters. The main idea behind it is so that when the water does come the building will be high enough off of the ground so that it is not affected by the water.

My variation on this age old concept is to try to create a structure that will fit the moving up idea but not appear to be just a structure that is build on stilts. The flooded condition diagram is a simple visual depiction of what has been done for ages.



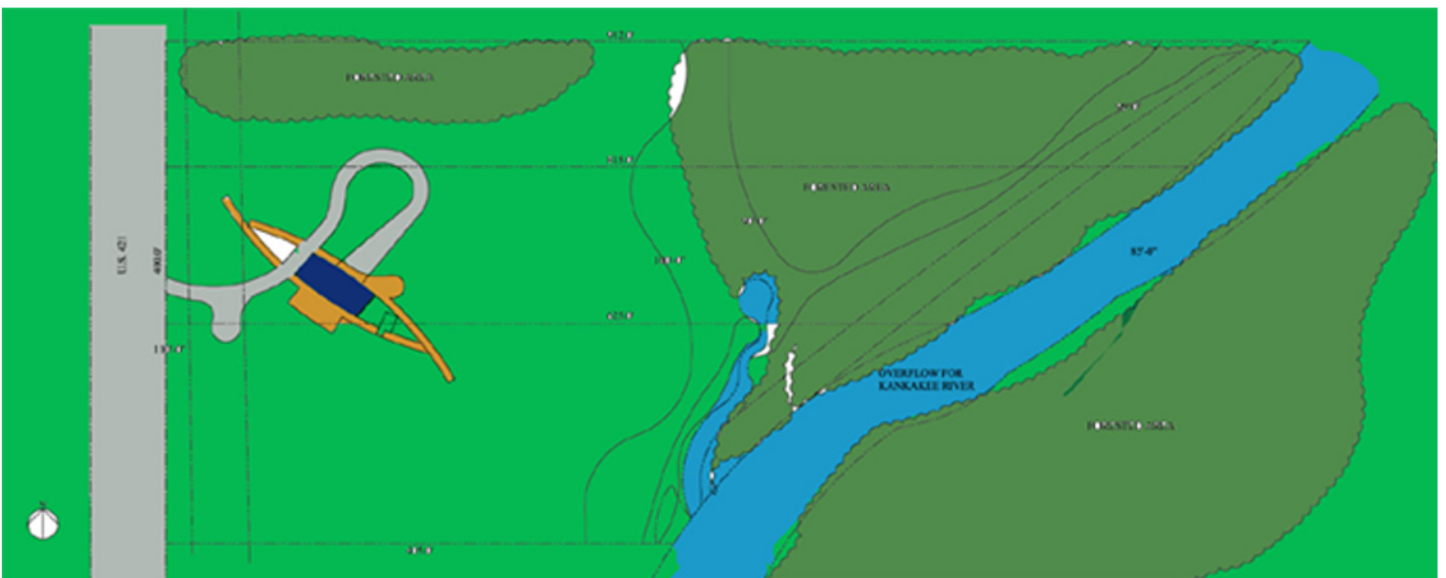
Docking

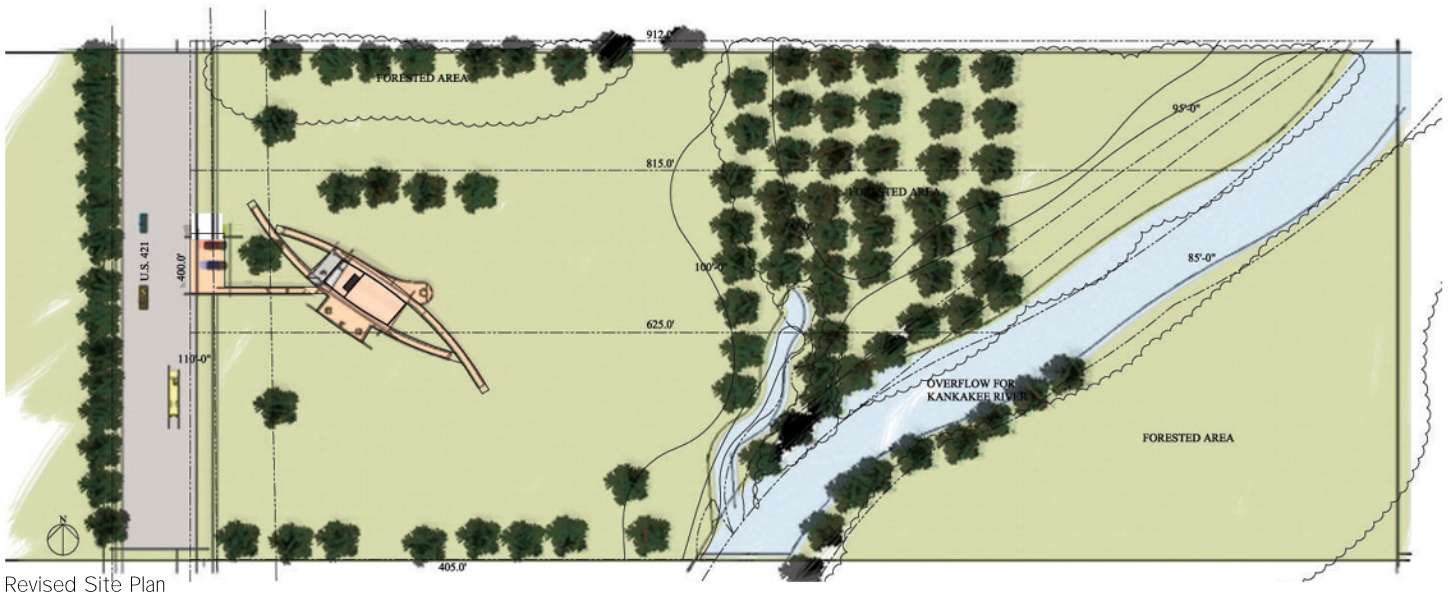
Another part of this ramping concept along with the moving up concept is to create a building and ramping system that will accommodate a boat at any level of flooding. This is providing that the water is deep enough for a boat to float.



Initial Site Layout

With the initial concept of the ramps established the next stage was to take the idea and turn it into an actual system. The initial idea for the ramps was to create a system that could facilitate foot traffic and vehicular traffic. This was to be accomplished by taking two ramps that would run along the long axis of the building and making those for foot traffic. The third ramp would then be for vehicular traffic which would originate from the road and run along the short axis to the building and then wind around to the rear of the structure.

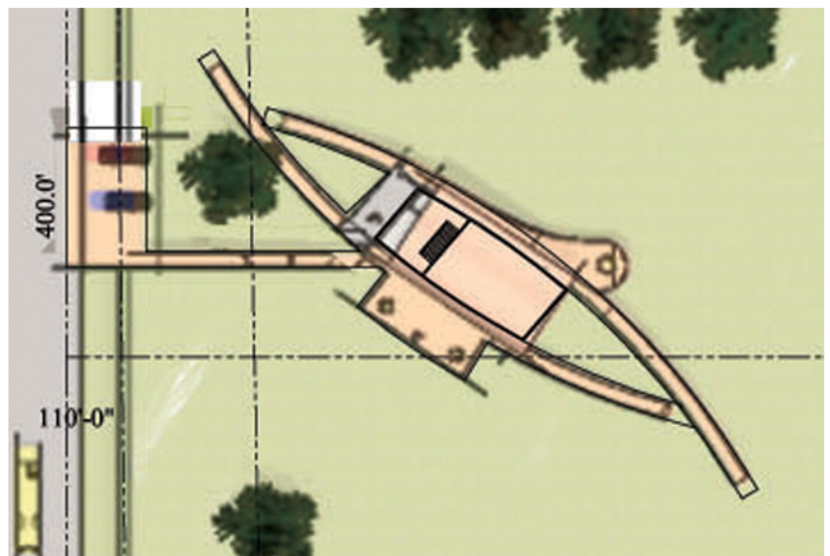


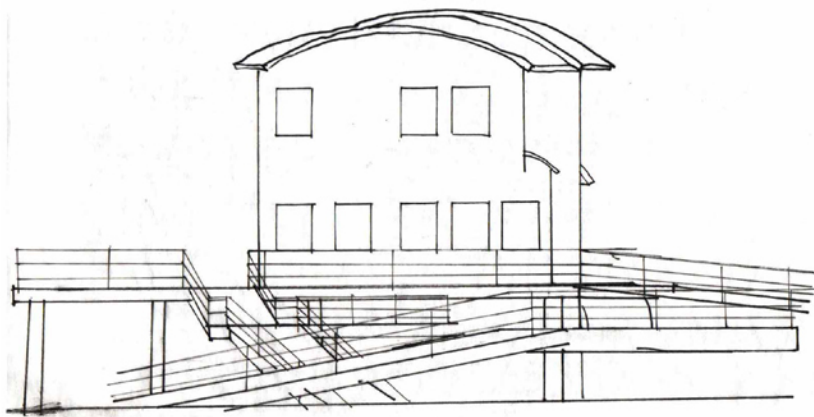
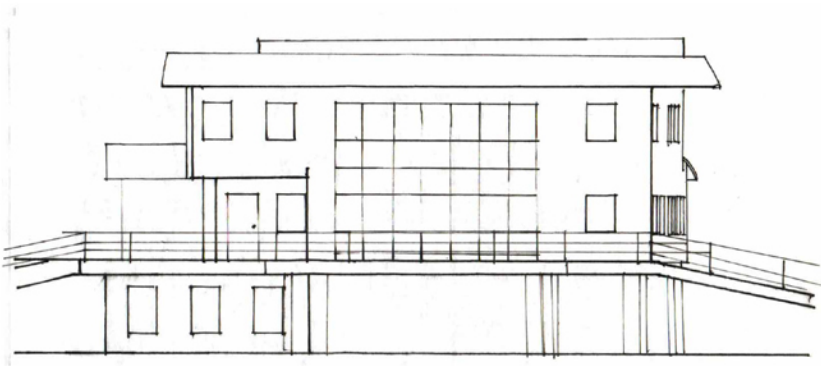


Site Concept

After looking at the initial concept for the ramping system it was revised to exclude vehicular traffic. Instead it was revised to accommodate parking off of the main road with a pedestrian bridge to connect to the main building and the other ramps to create the system.

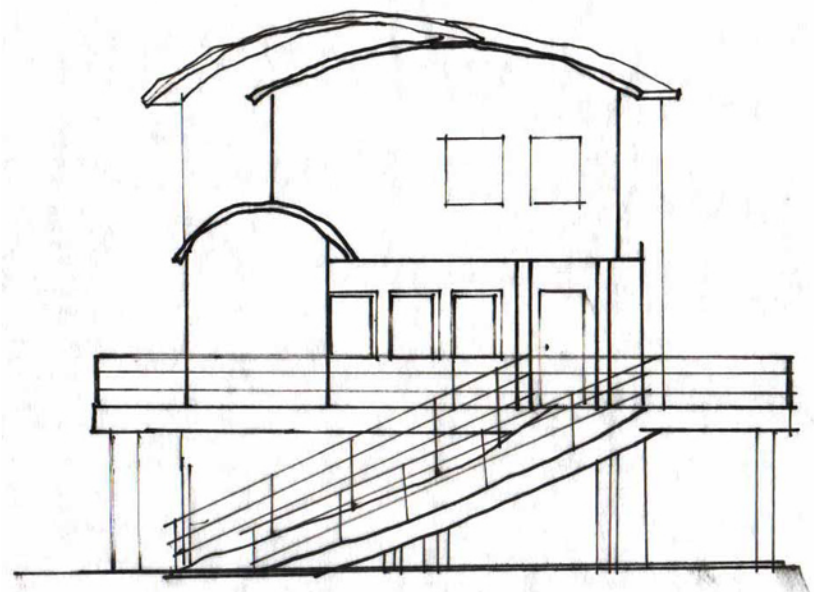
This revision was made to try to create a better aesthetic and to give the option of parking under the structure during times where there is no flooding.

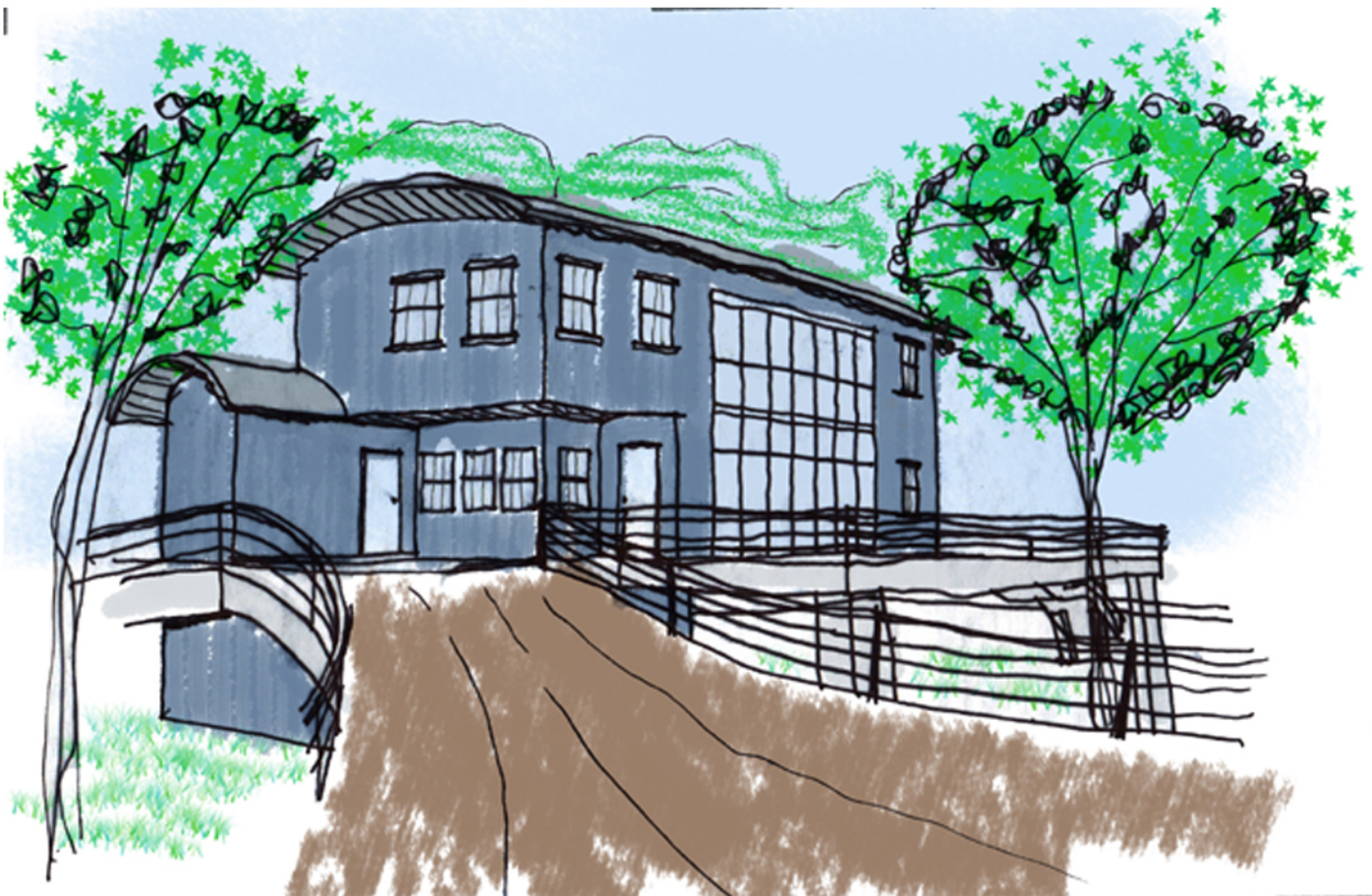
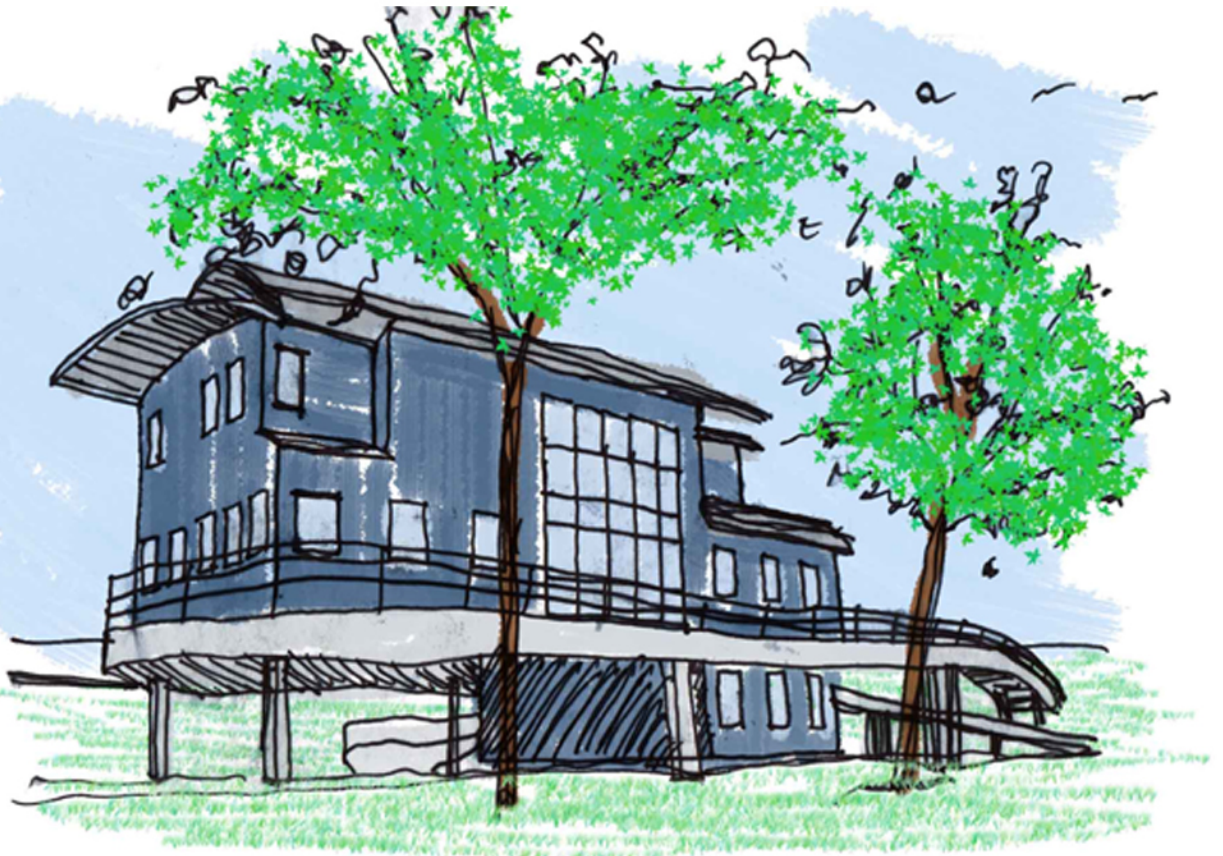


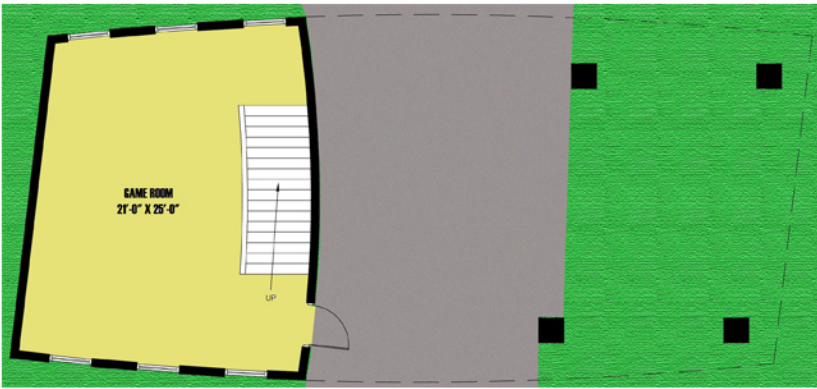


Initial Building Study

After creating a working site, the next step was to try to create a building type that would embrace the ideas that I wanted to use. The first step was to try to create an integration of the building and the ramping. I let the ramping system itself determine the shape of the building. This was done by taking the ramps and interweaving them together to create a void amongst the ramps. I then took that void and started to create conceptual elevations. From those elevations I created some rough perspectives to try to see what the building might look like.

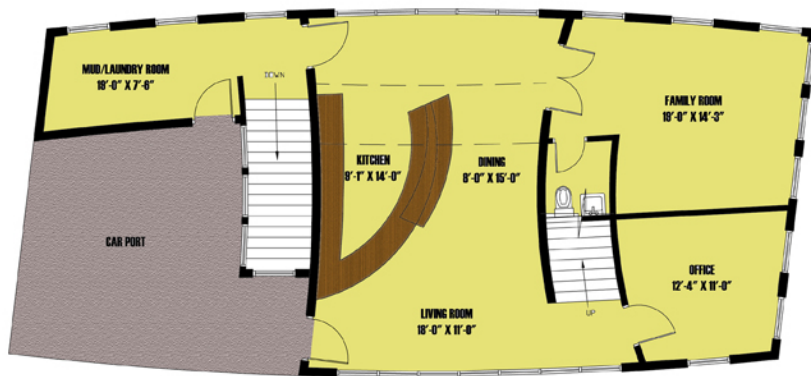






Initial Ground Floor Plan

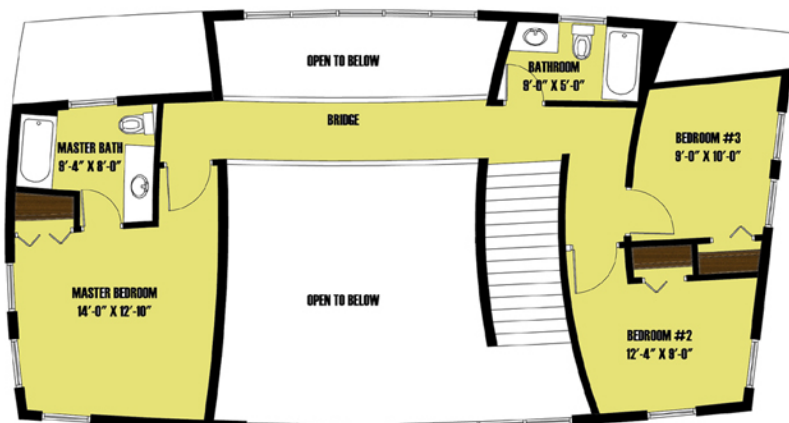
From the building form that was created by the ramping system, The next step was to create a floor plan that could work. The start of the plan was at the ground floor. This floor was designed with the concept that during times of flooding that this room would be a wash out room. This meaning that all the materials that went into creating this room would be able to be submerged and not be damaged and or have minimal damage to the room.



Initial First Floor Plan

This plan was created with the idea that a vehicle could pull up to the building and park on the ramping system that was created. From that car port the occupant of the vehicle would have two options. The person could enter through the Laundry room or the living room. From either point they could then proceed to the Kitchen or dining room. From the kitchen the person could then proceed to the family room or walk back through the living room and either continue to the office area or travel up the stairs to the second floor.

The core of this plan was an open concept so that the living, Dining, and Kitchen areas were all in one large space with windows on either end. By creating these two story windows it would allow an exurbanite amount of light into the space to give the occupants maximum natural lighting.

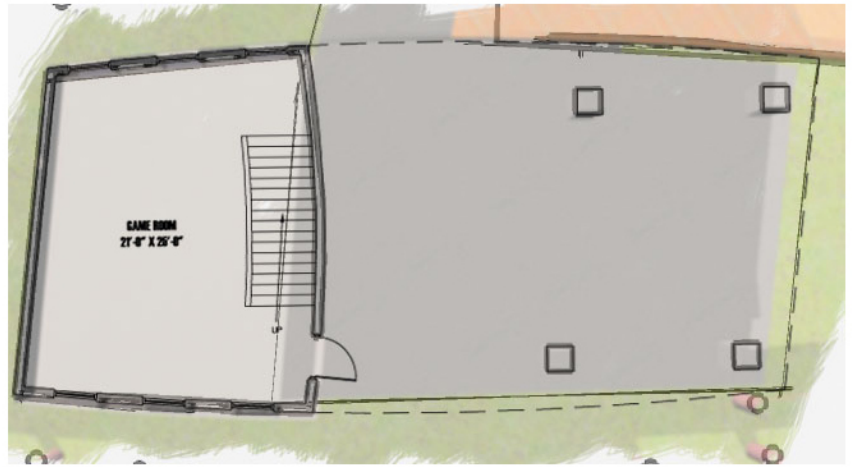


Initial Second Floor Plan

This plan was designed to separate the master bedroom from the secondary bedrooms. This was done to give the owners of the building maximum privacy. Also with this concept it allowed a bridge to connect the two sides of the building that created a walkway that could look down onto the first floor. This bridge also gave a view of the surrounding area through the large windows in the front and back of the structure.

Revised Ground Floor Plan

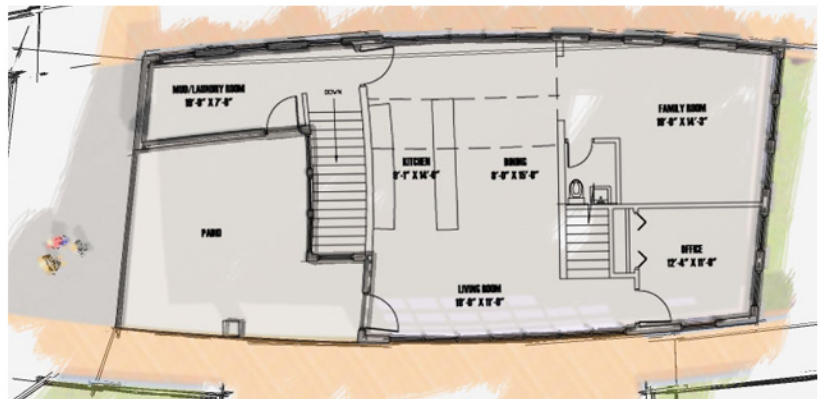
The ground floor of the project didn't change from the original concept.



Revised First Floor Plan

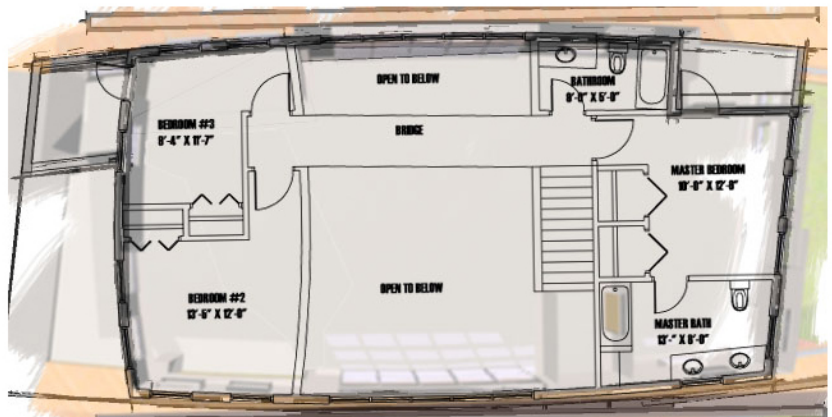
After working with the initial first floor plan some revisions were made. The curved walls that were throughout the building seemed forced and created space problems. These space problems were creating odd rooms that were not functioning in a efficient manner. By changing the walls from curves to flat plains it helped create a more functional plan that allowed more space for the rooms themselves and a more functional flow.

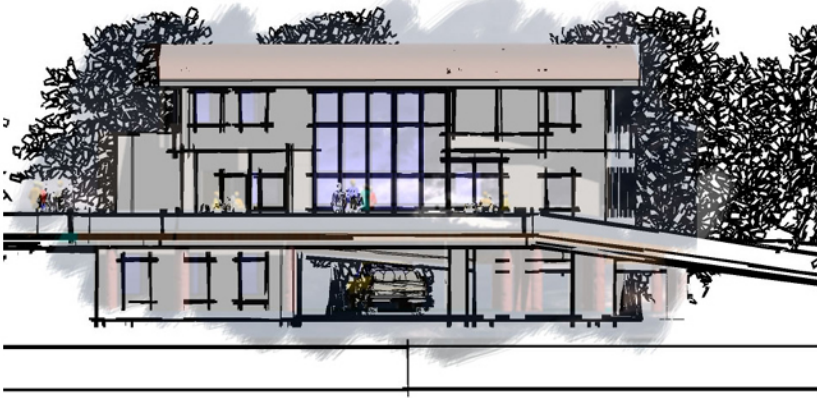
The car port was changed from a car port to a usable deck that was covered and could possibly be screened in if desired. This change was made due to the removal of vehicular traffic from the ramping system.



Revised Second Floor

This plan was revised to take advantage of the plainer walls just like the first floor. The walls were changed to accommodate the plainer walls and created more usable space. While doing this change the master bedroom and the support bedrooms were switched around in the building to give the owners of the building a better view and more usable space.

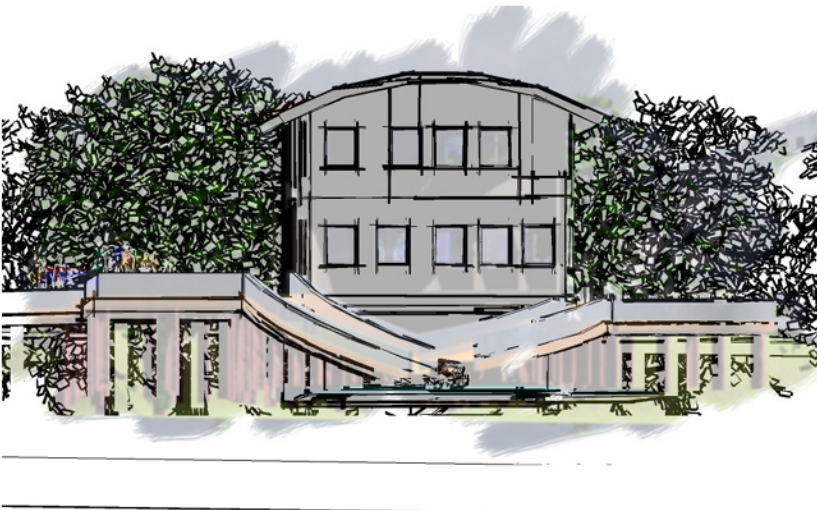


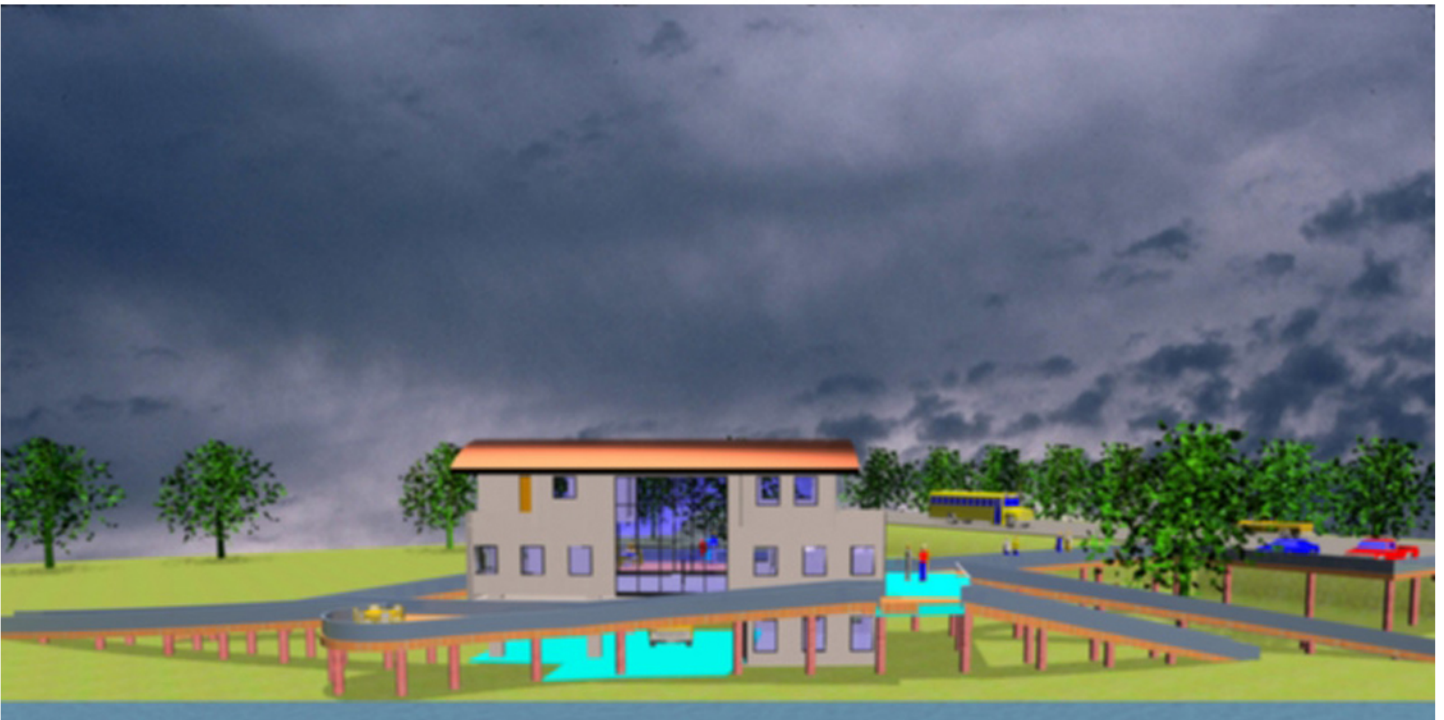
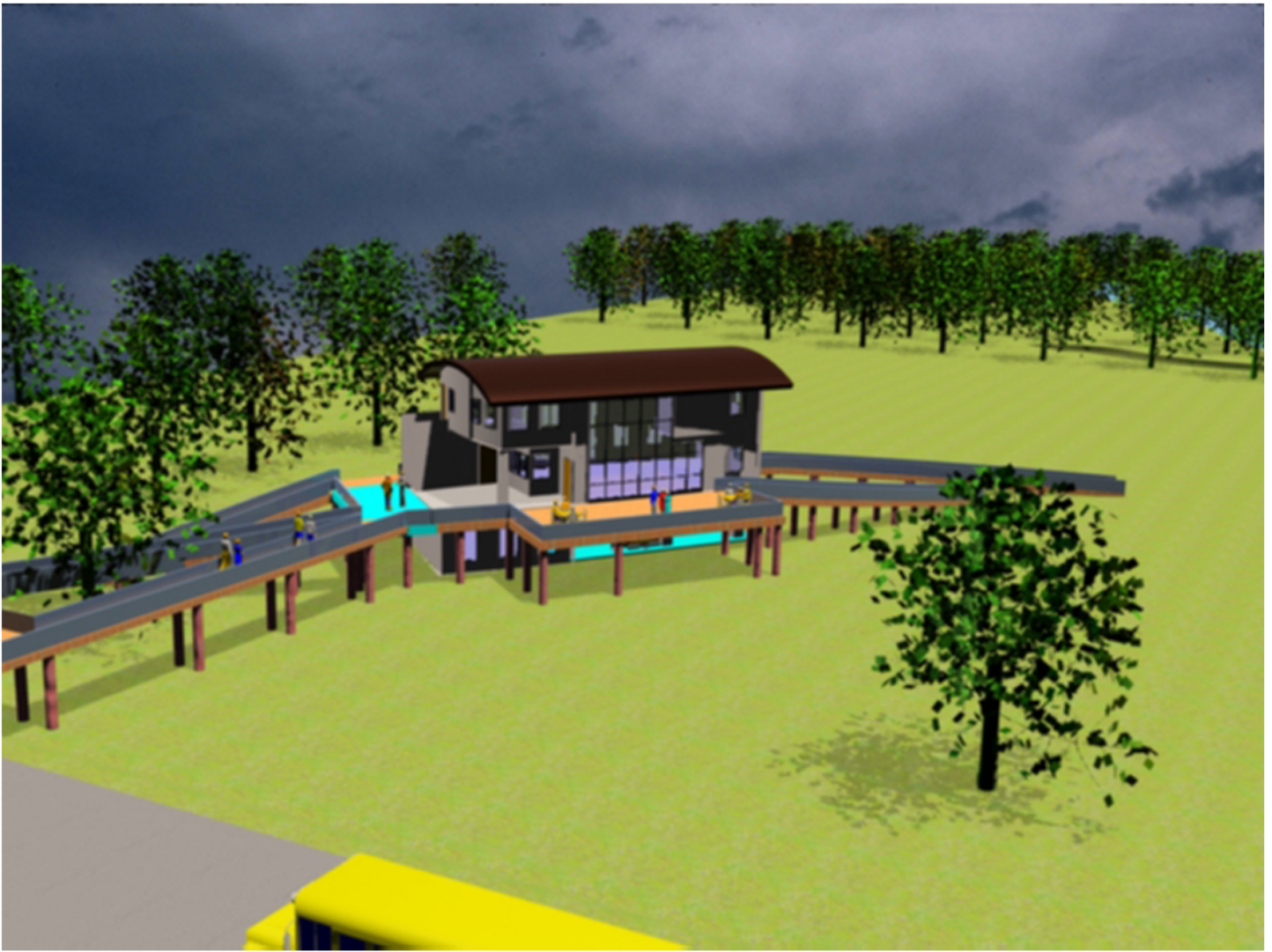


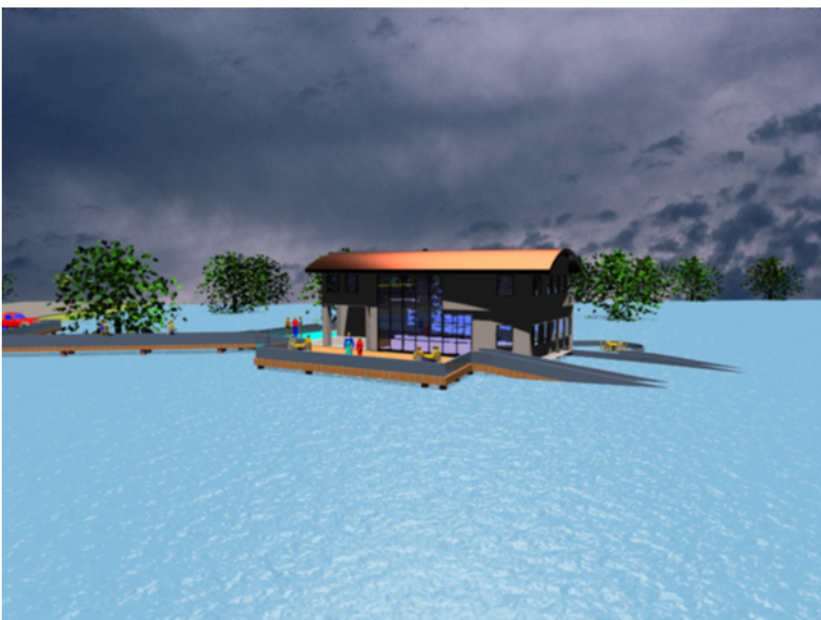
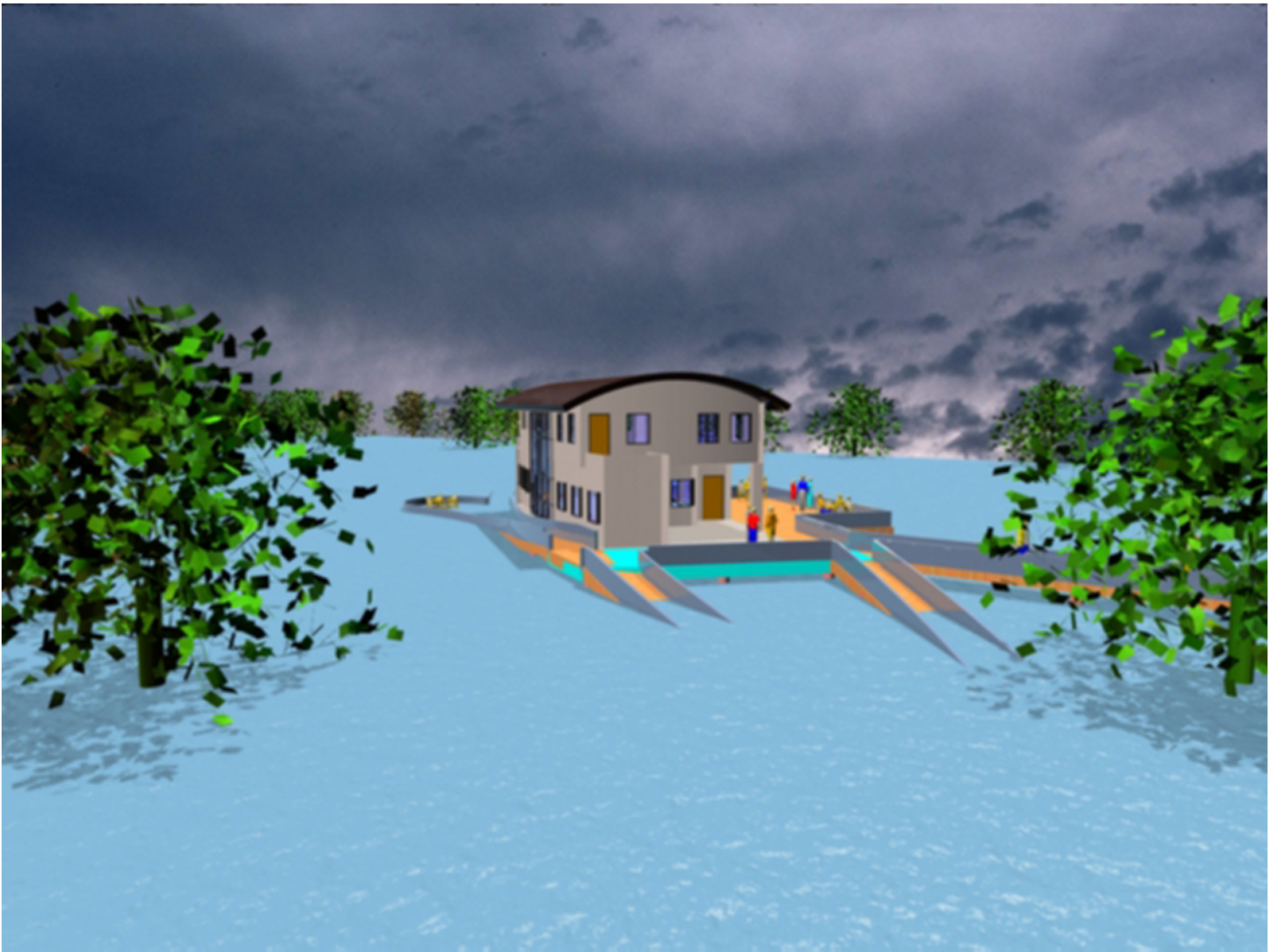
Revised Elevations and Perspectives

After studying the conceptual plans, elevations, and revised plans I created new elevations. In these elevations the initial ground floor was not changed, but every thing from there up was revised. The first floor changed because of the way the ramps changed. This is reflected in the elevations by not having a overbearing drive running on the short axis of the building. As for the second floor of the building the roof system was changed from multiple curved roof surfaces to one continuous curved roof surface. Also the openings for windows and balconies were revised to only have two balconies on the second floor.

The perspectives are shown to give an overview of the system and to what extent the system reaches on the site.



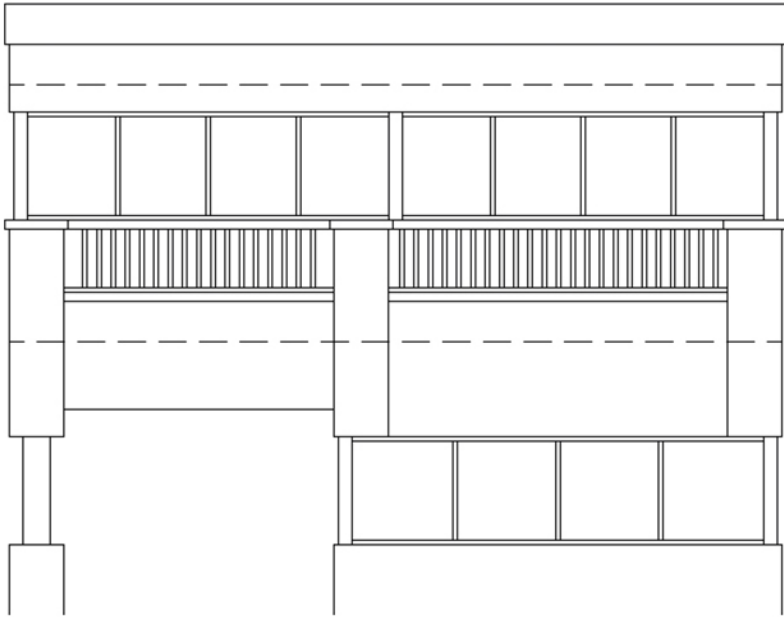




The System In Action

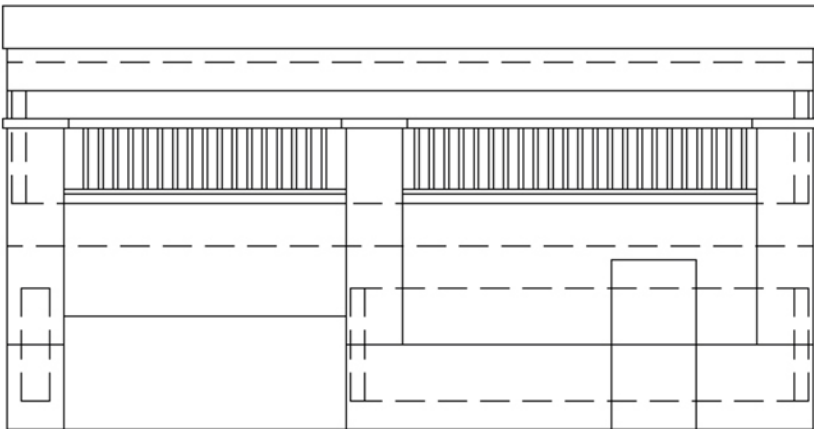
During the times of the year that are flooded these images portray the system functioning in the most sever flood stage that could happen. As shown in the pictures the ground floor is completely submerged and the ends of the ramps are also submerged. The living portion of the building itself is still high and dry and the main areas and passageways are still functioning. With these ramps the land and area around the building may be unusable but the decks and ramps at the first floor level are still functioning. This in turn keeps the occupants of the building unaffected by the natural conditions of the area.

Florida "Closing Up"



Initial Design Concept

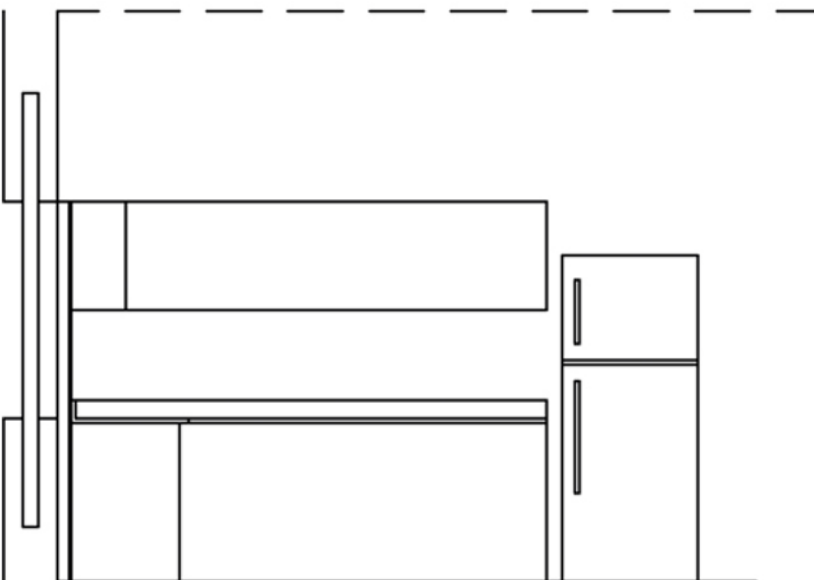
The first stage that was taken in the Hurricane concept was to think of how to protect the building and its contents. My first approach to this problem was to try to create a building that could collapse in on itself. This would be done through a hydraulic system that would be integrated into the building itself. Also all of the walls within the building would have to be specially designed to be able to slide into itself.



Problems

1. How do you create a wall that can compress into itself without damaging the wall surface.
2. How do you make interior fixed objects, such as cabinets, plumbing fixtures and pipes able to be moved without having them damaged.
3. What about interior objects that are attached to the walls themselves.

With these as the short list of problems to overcome it proved to be an unfeasible system to try to pursue but the concept of closing up the building was carried on to the next idea.



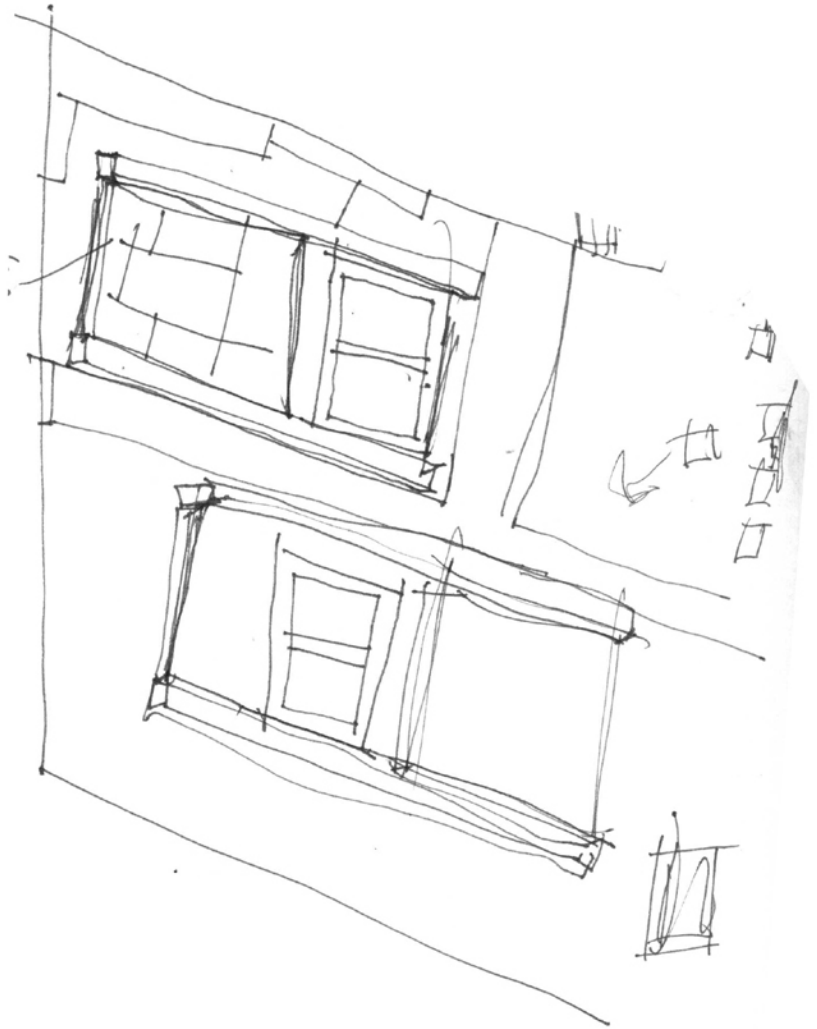
Secondary Design Concept

After studying the initial concept of making the building collapse in on itself I revised the idea to a possible shutter system. The first revision of this system was to try to see if panels that were fitted to the exterior of the building could be used to cover the fragile openings in the building. These openings were mainly windows and doors.

The system itself would be an alternative to going out and buying plywood or some other material to put over the windows and doors on a home. Instead it would be fixed to the building in a way so that the owner would only have to slide them into position when needed.

Problem

With this idea the panels that were there to protect the home would be unsightly in my mind and would limit how a house could be designed and also could potentially have problems with being retro fitted to existing buildings.

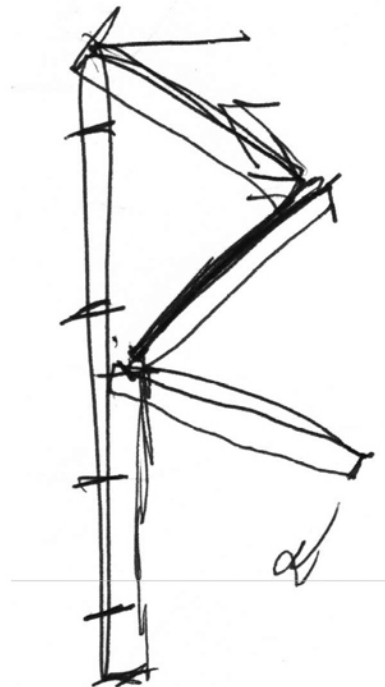


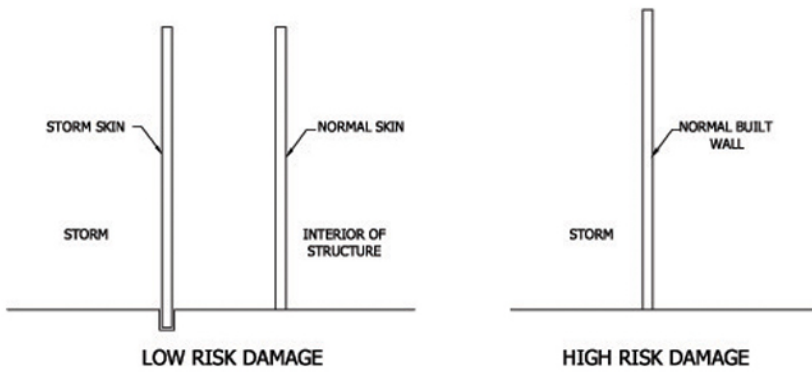
Modification

After studying the shutter concept I then took it and changed it so that the shutter system would not be as visible. I accomplished this by creating a decking system that would wrap around the building. With in this decking system the shutters would be part of the deck floor. When they were needed they could be raised into position covering the delicate areas of the building.

Problem

This system would be complicated to make work with existing buildings and on second floor areas creating a pulley system to move the panels up into position would probably hinder the function of the deck itself.





Final Revision

After studying the problem with the shutters I then looked at the idea of shutters in a different way. I decided that instead of just placing a barrio over a specific area of the building why not create a secondary skin. By creating a secondary skin that could enclose the actual building it would minimize actual exposure to the elements. I looked at it in the sense that if there is only one barrier between the inside and outside that if it were damaged in some way then it would not matter if the fragile parts of the building were covered. If I could place a outer skin around the building that didn't necessarily touch the building skin then it would be a stronger defense against the elements.

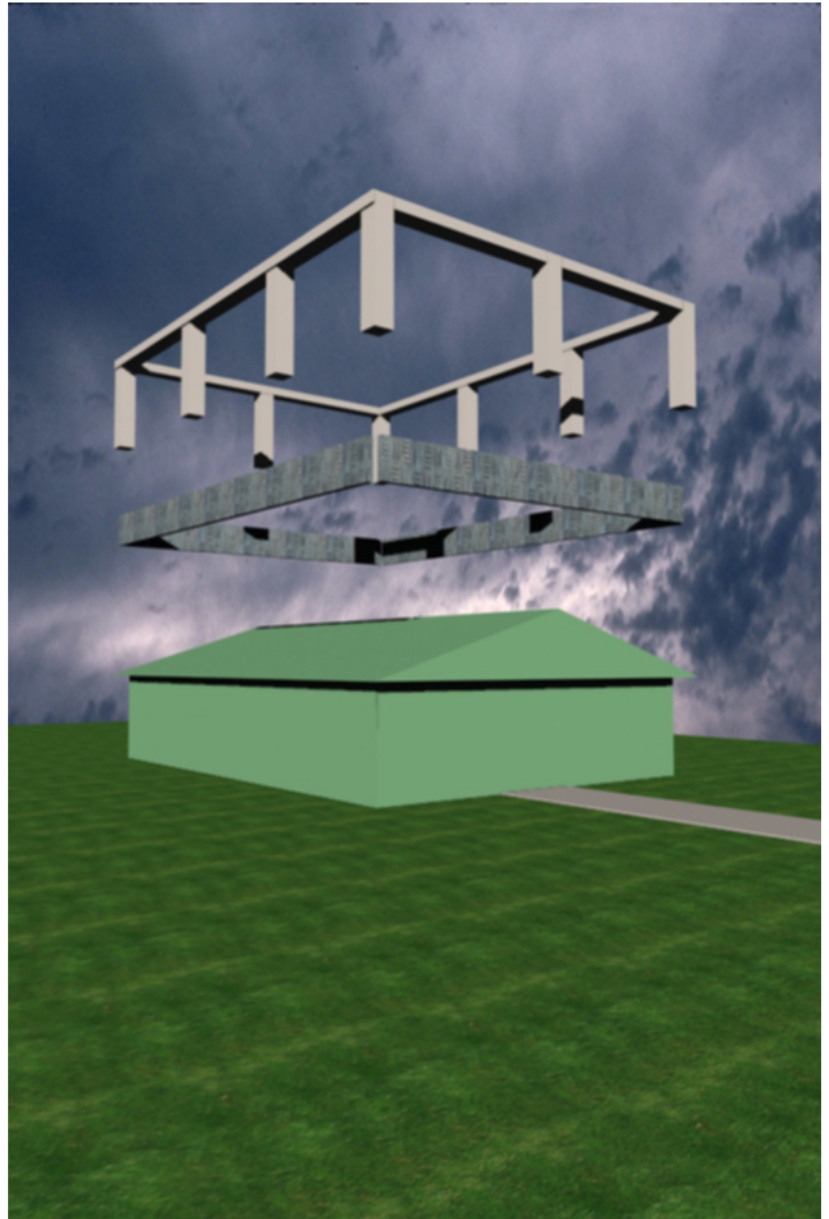
As shown in the diagram to the right, the outer skin would recess into a channel in the ground to create a seal that would help prevent water infiltration and the skin itself would become a shield that would stop heavy rain and wind. Therefore creating a shield that would prevent major damage to the structure.

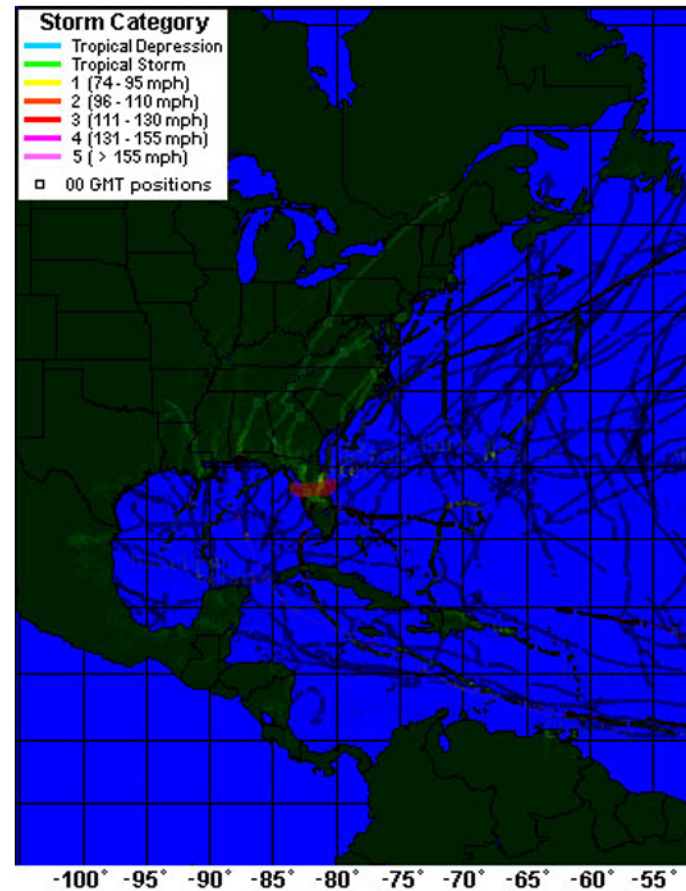
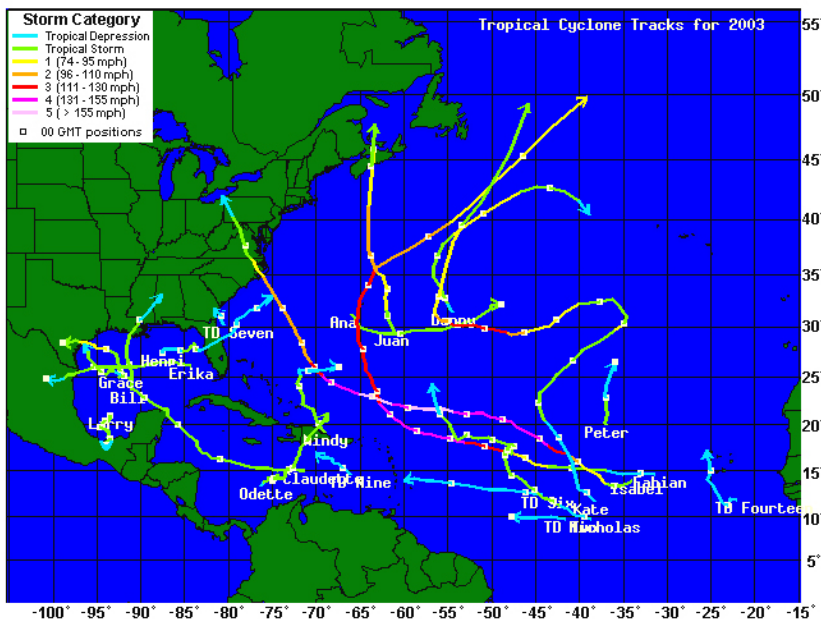
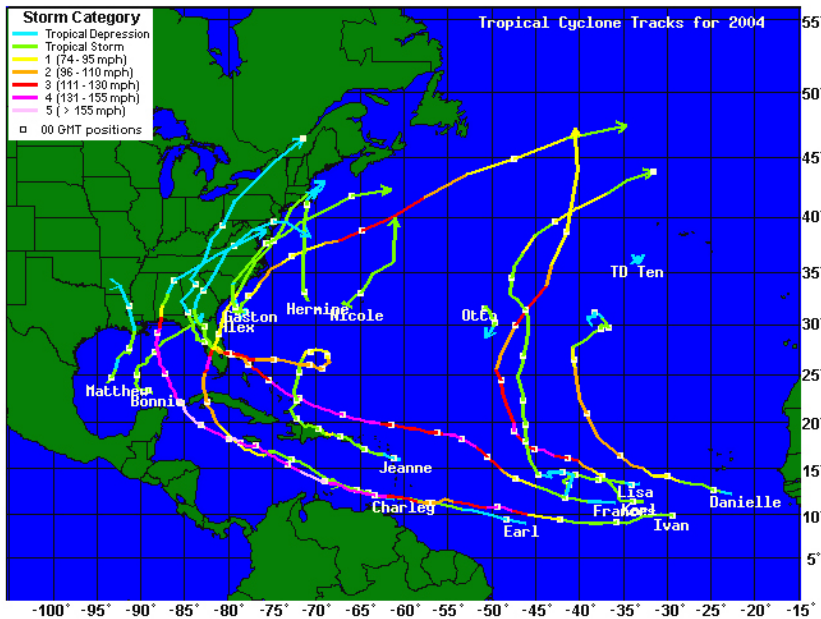
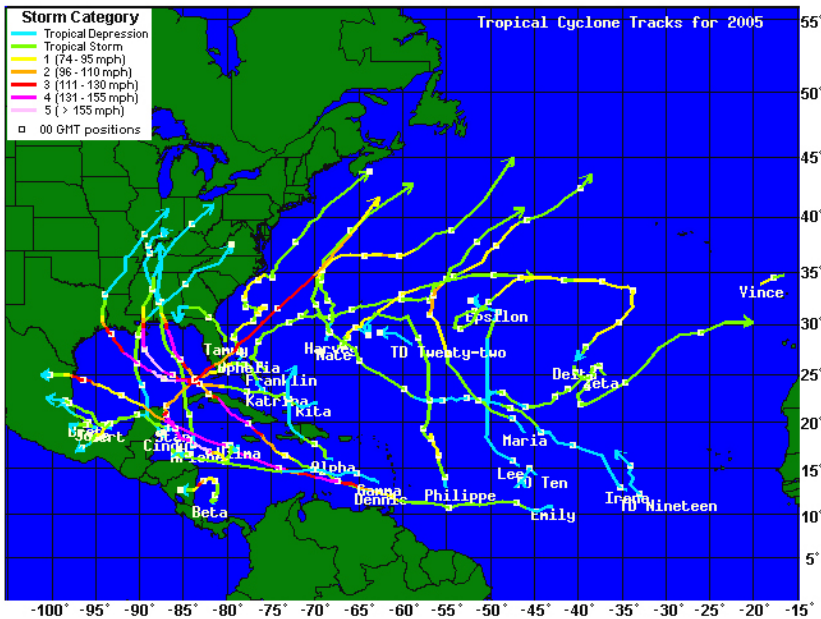
The study perspectives shown here give an idea of what the building could look like in the everyday mode and the defensive mode.



System Parts

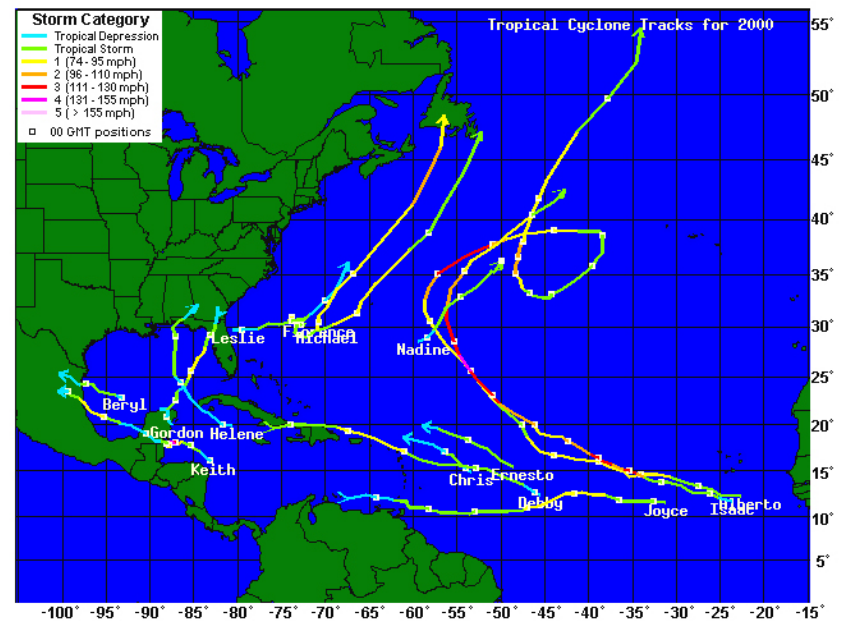
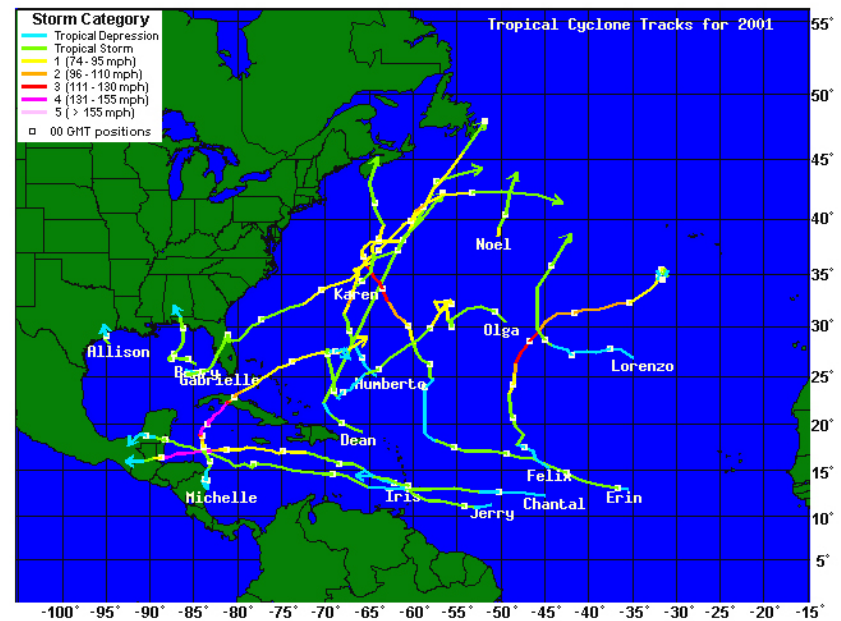
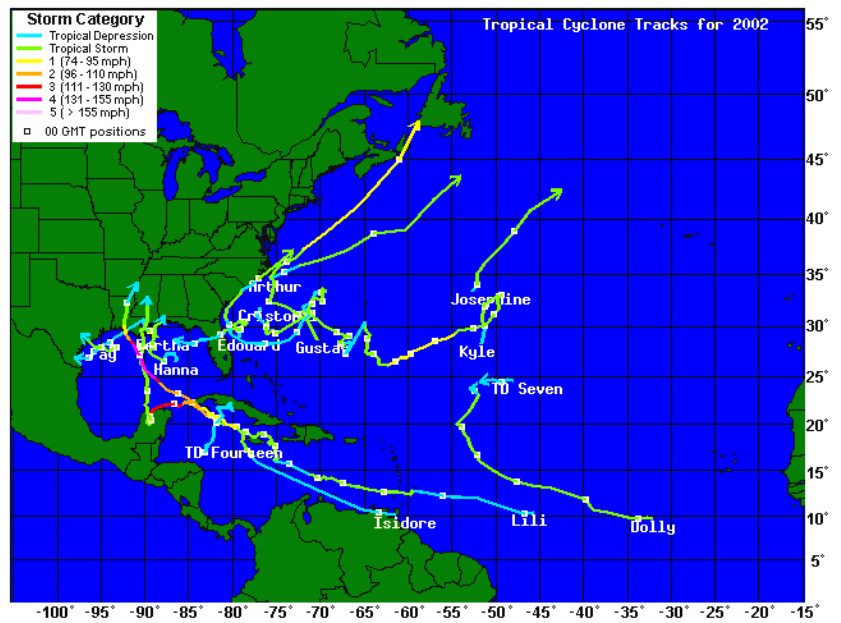
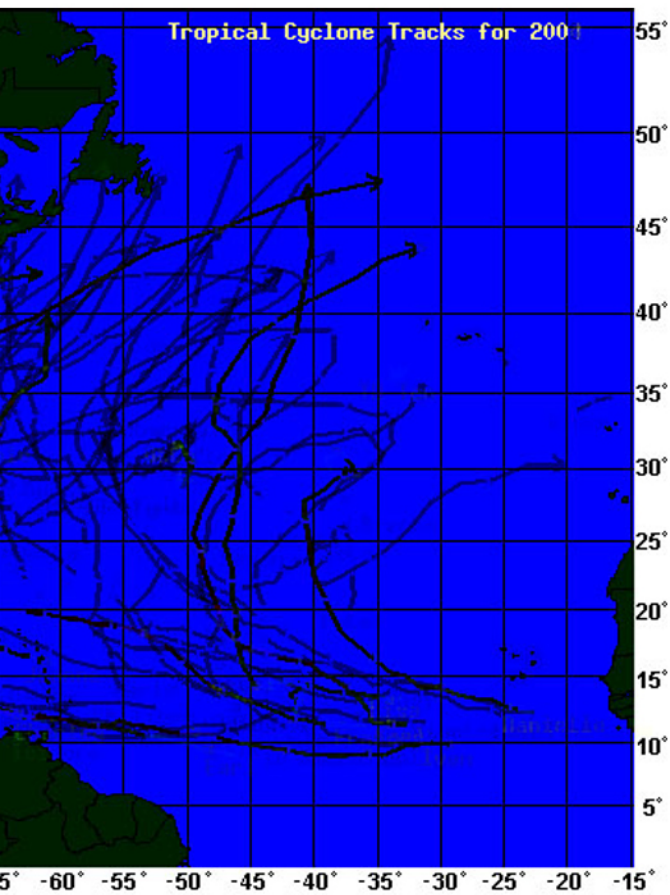
The diagram on the right shows the basic parts of the retro fit system. It consists of a exterior structure that would be fitted with vertical channels with seals on them for the shield doors to travel down. The horizontal members of the structure would be rolling shutter housings that would contain the shield doors and sit on top of the vertical channels. The shutters themselves would be made of a rust proof metal that would withstand heavy winds and impacts. All of this would then be fitted around the building to create a secondary skin

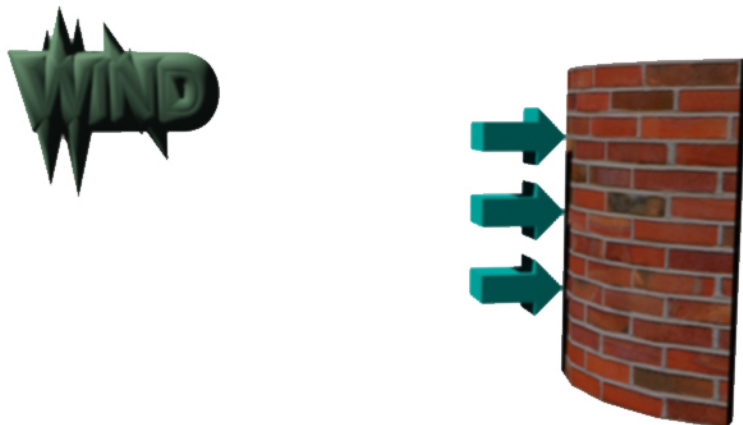
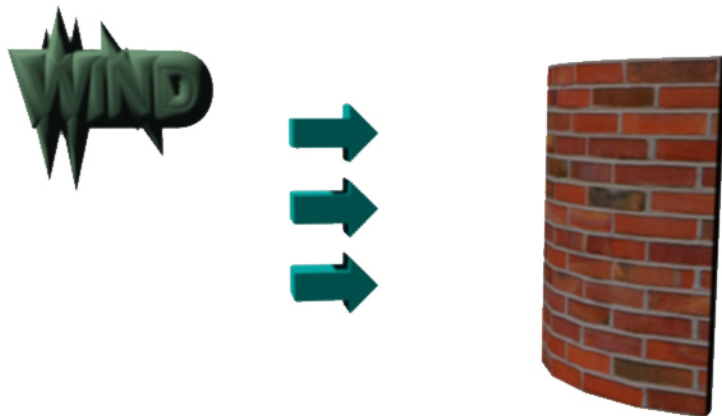
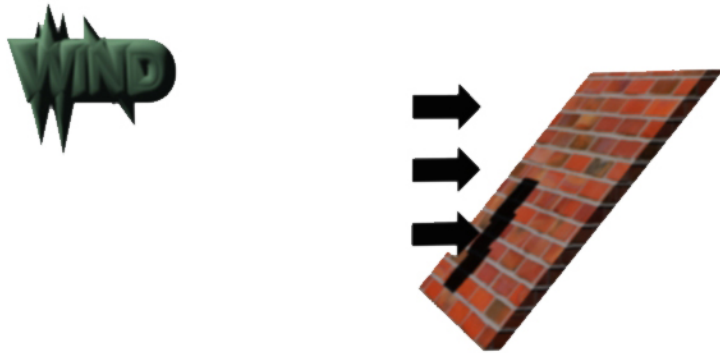
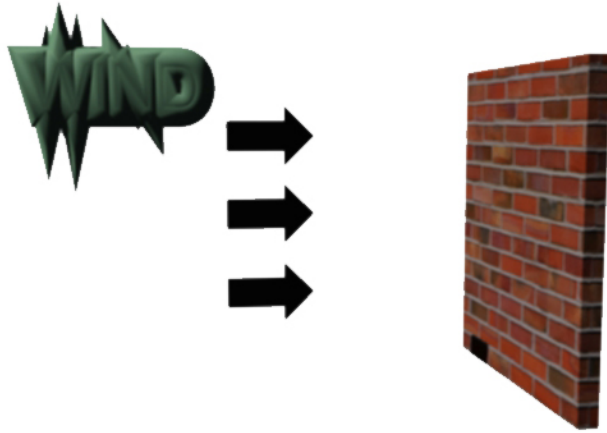




Site Selection

After creating the shield system I then went and looked at the last six years of hurricane patterns to determine where a good location for the shield system to be located. I determined from overlaying the maps that the central part of Florida would be an idea placement for this system. From that point I went and looked at the land contouring of the area and determined that it is mostly flat land with little variation. From that point I decided that the best location for designing a building with this system would be along the cost line. After determining that it would be located along the cost line I then created a generic site plan that could be seen as any coastline along the state.





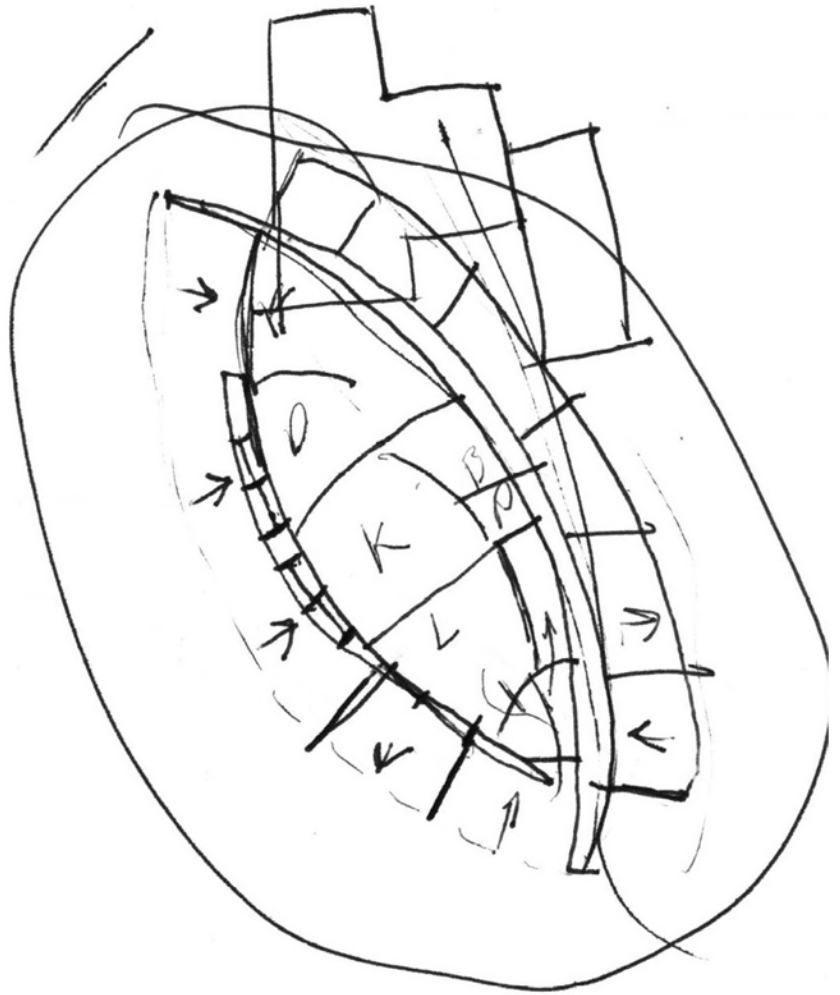
Flat Wall VS. Curved Wall

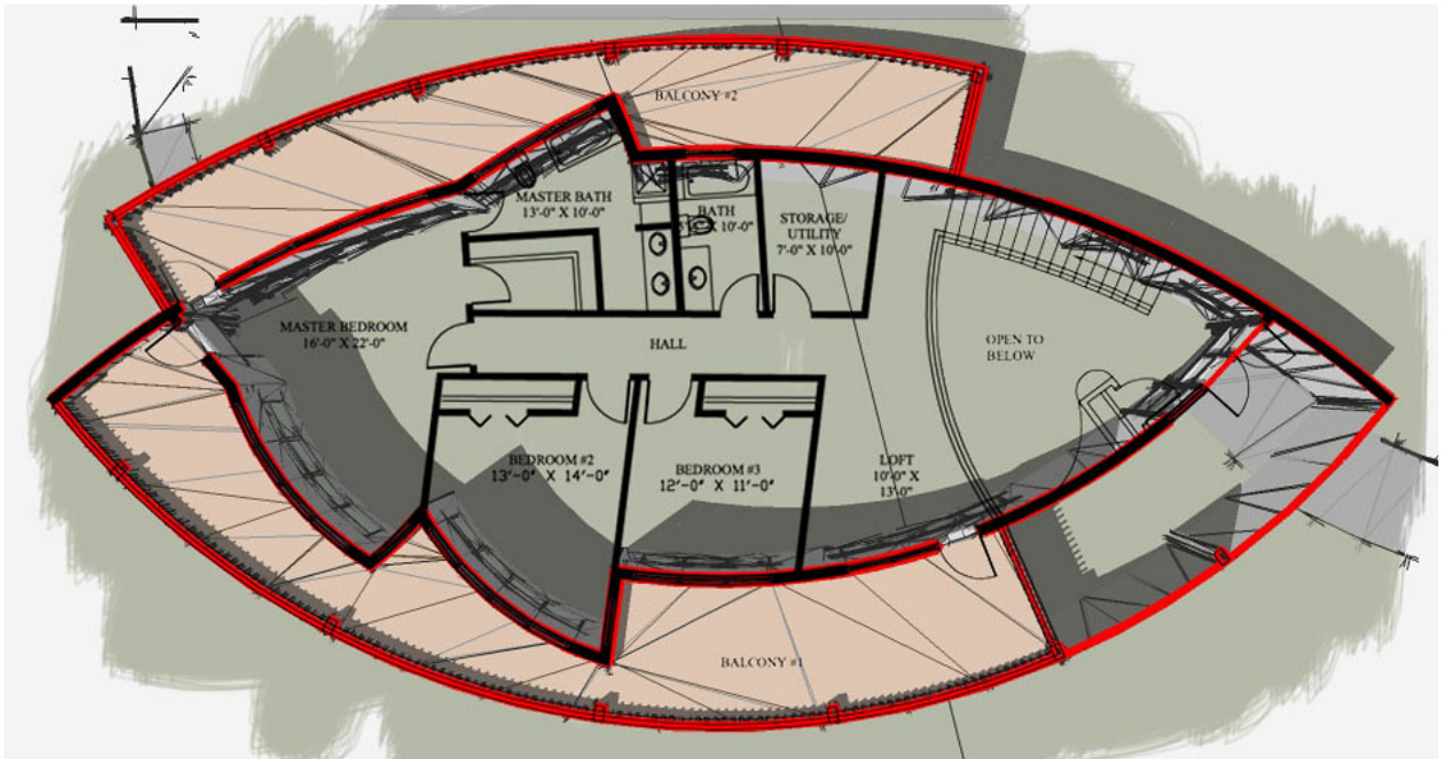
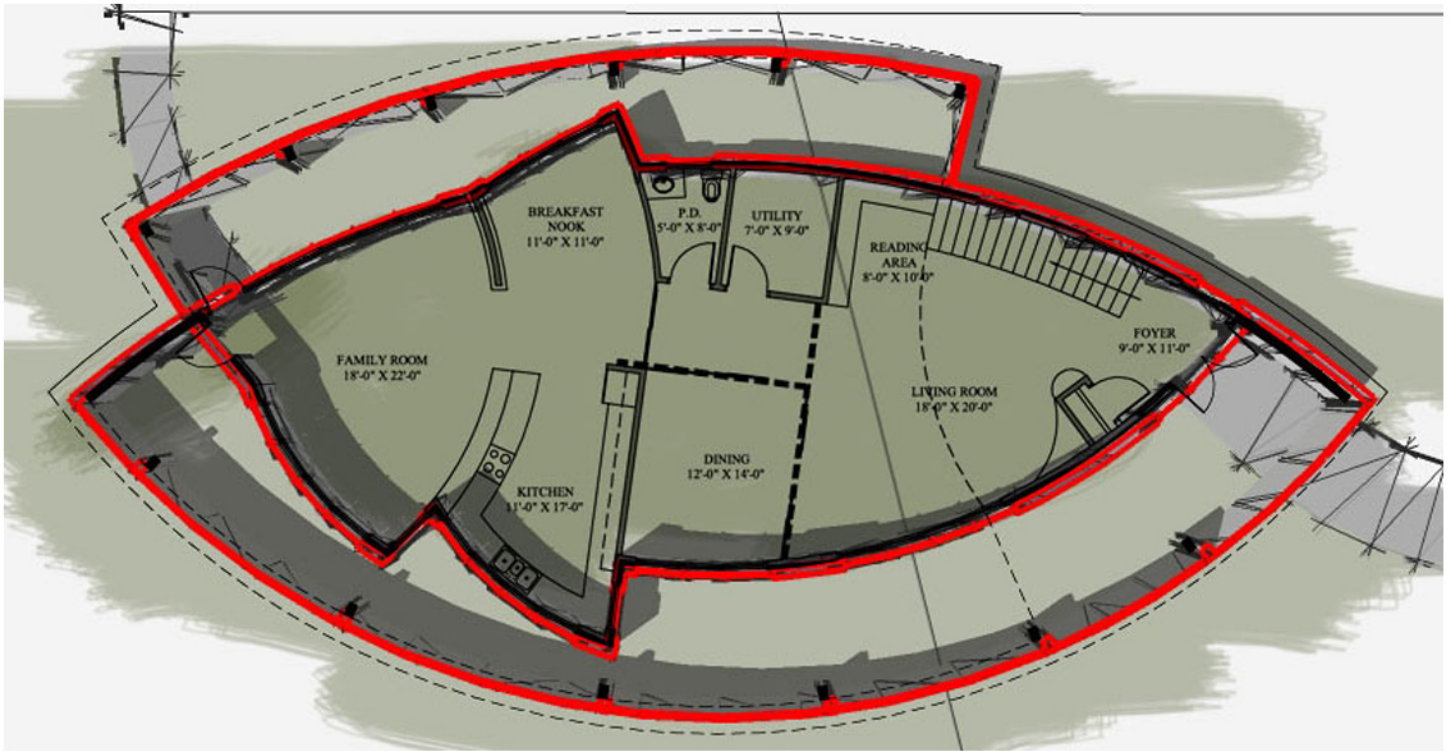
After determining the site location and creating a generic site I then looked at what type of wall would be more conducive to let wind and rain flow around it instead of threw it. I looked at a standard flat wall vs a curved wall. By looking at these diagrams I determined that if I used a flat wall that given a strong enough wind that the wall would buckle and either push in or flex and then fall in. With this problem established I then looked at a curved wall. This wall type proved to be more conducive to driving winds and rain. I choose to use this type of wall because a curved wall creates its own strength. The harder it is pushed on the stronger it becomes.

The diagrams themselves show how a flat wall will be pushed down in heavy wind and it also shows how a curved wall will stay in it's original shape.

The Building Design

Since I had determined that the walls that made the exterior of the building should be curved to allow better wind and rain deflection I then created a basic idea for a floor plan. This floor plan concept would create a building that would be curved on all sides to try to take advantage of the curved shape. I then decided to make it a two story structure with balconies on both sides so that it would play into the shielding system.





The Final Floor Plan

The first floor was created as a standard open layout for a residential home. It has the front entry connected to the staircase to the second floor and to the living room area. Within the living room area it is open to the reading area and to the formal dining room. There is a wall separation from the formal dining room to the kitchen to give space for cabinets and appliances. Once in the kitchen it is open to the breakfast nook and the family room. In the dining room there are sliding panels that can enclose the dining area to give it more privacy if needed.

Also on this floor is the powder room that is centrally located and the utility room. On this floor the utility room serves as storage and basic utility room services.

The Final Second Floor Plan

On this floor there is balcony which serves as the open office and is then connected to the sleeping quarters and full baths as shown in the plan. The special part about this floor is the secondary utility room. This utility room houses backup generators and the controls for the shutter system. This room is located on this floor in case the first floor is inaccessible or damaged in some way that would affect the operation of the system. Also located on this floor are the two decks that help enclose the buildings second skin.

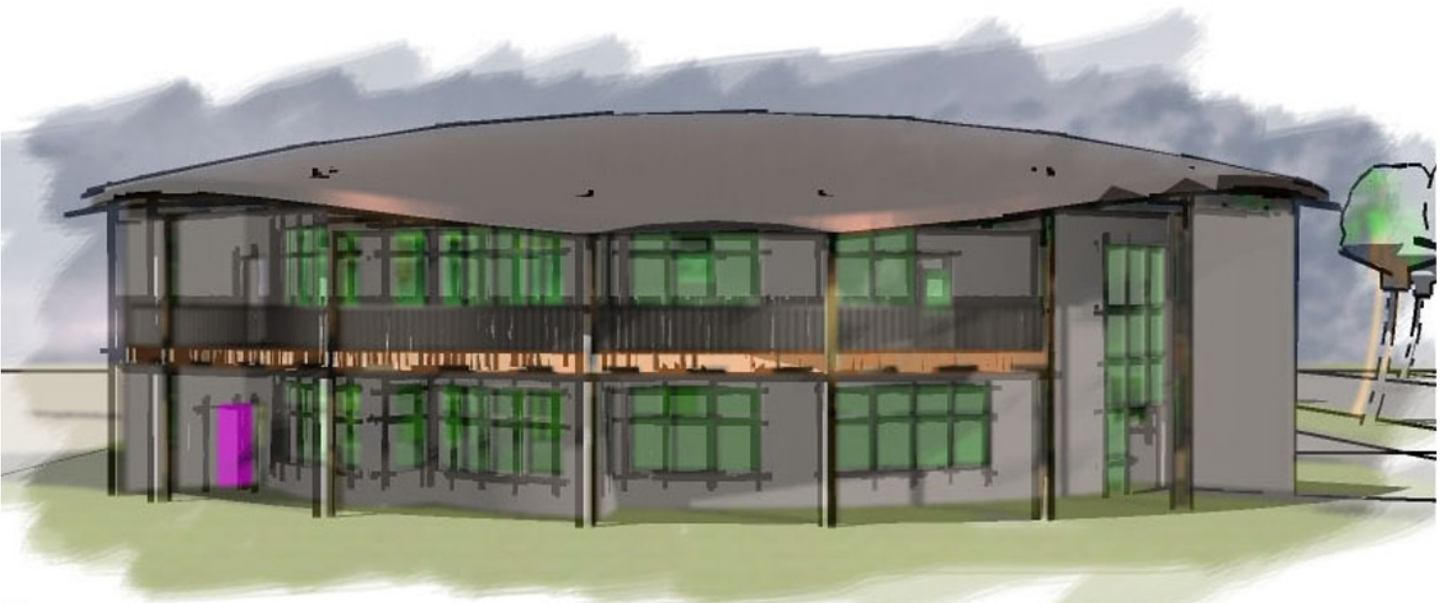


Elevations

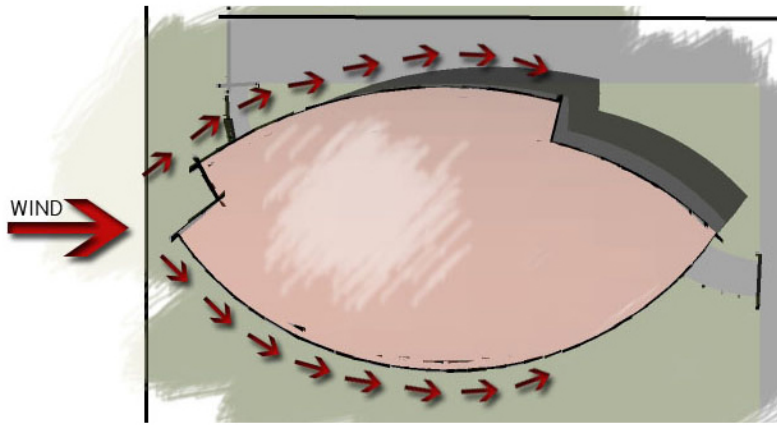
From the plan I created elevations. These two elevations show a typical front elevation and side elevation when the building is in a non-defensive mode. The building was designed to take advantage of deck spacing and so that it could be oriented toward the ocean itself on this side to try to provide a view.

Perspectives

The top perspective is looking from the beach toward the building and the lower perspective is looking from the street toward the building

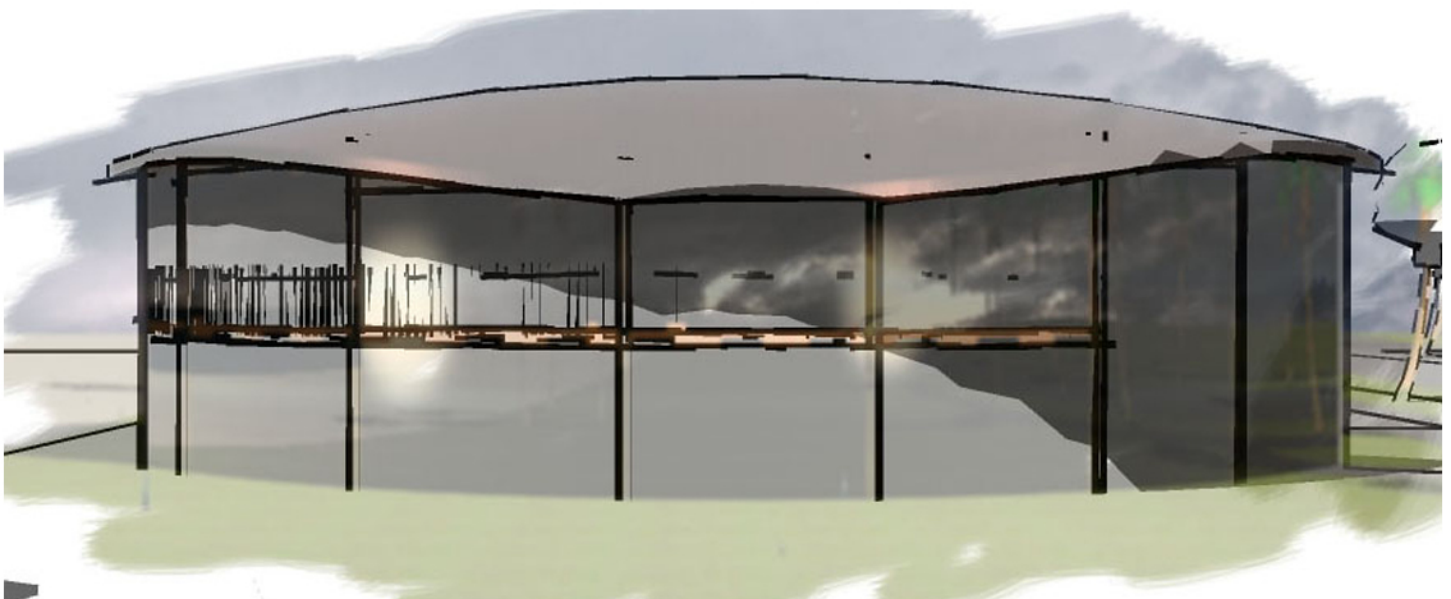


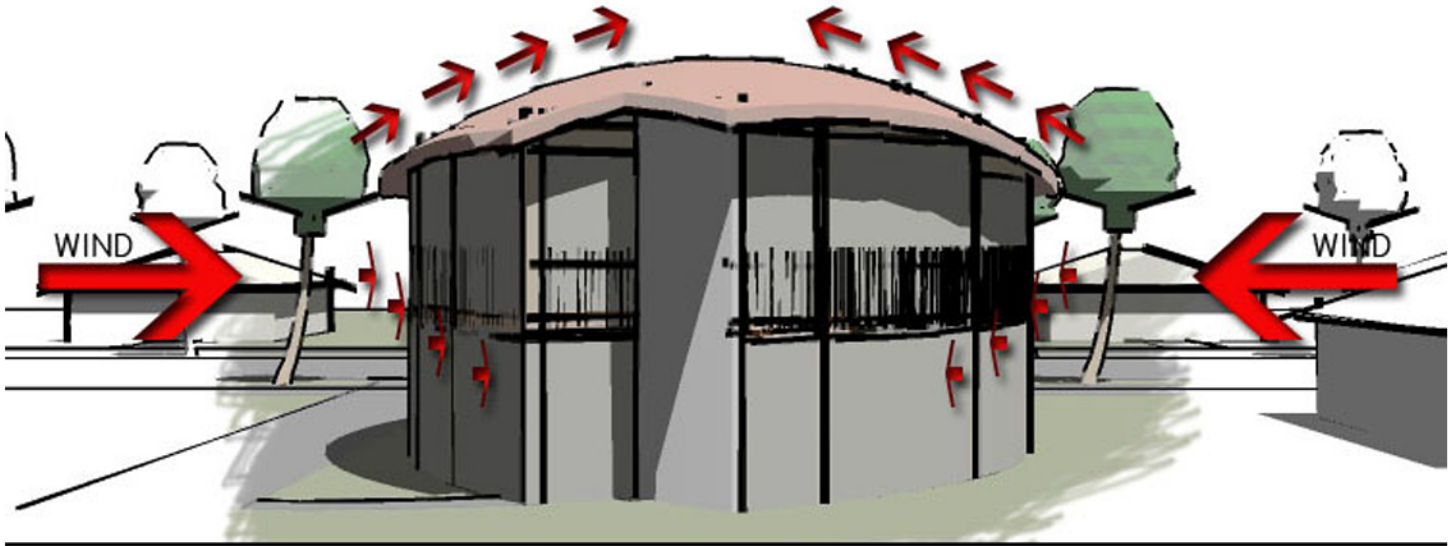




Closed Elevations

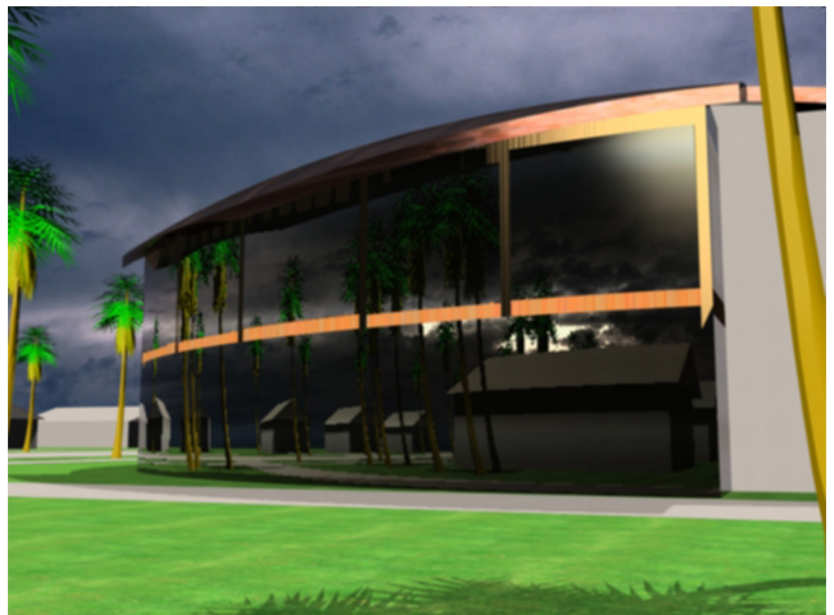
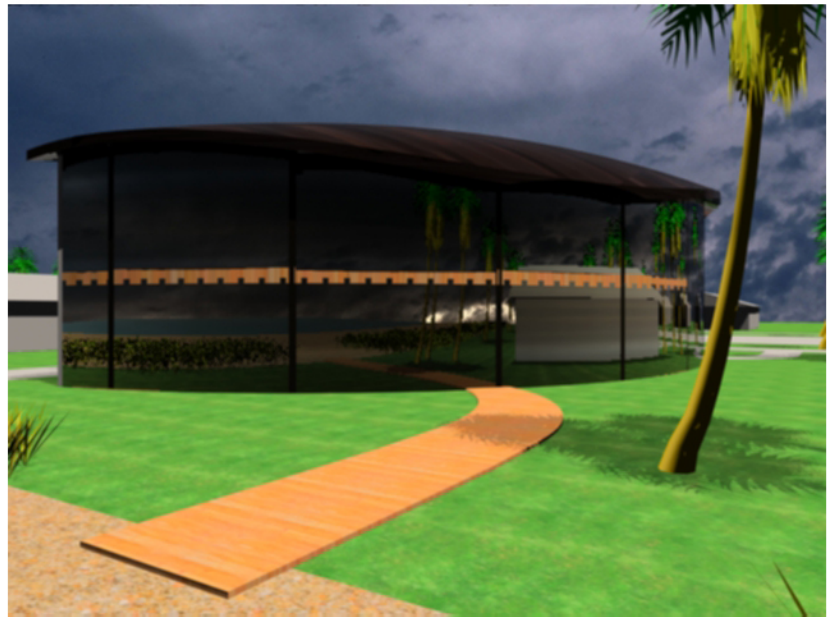
This set of elevations depicts what the building could look like when it is in full defensive mode. The diagrams show that the wind will move around the structure and any heavy rain will also glide around the structure rather than into the structure itself



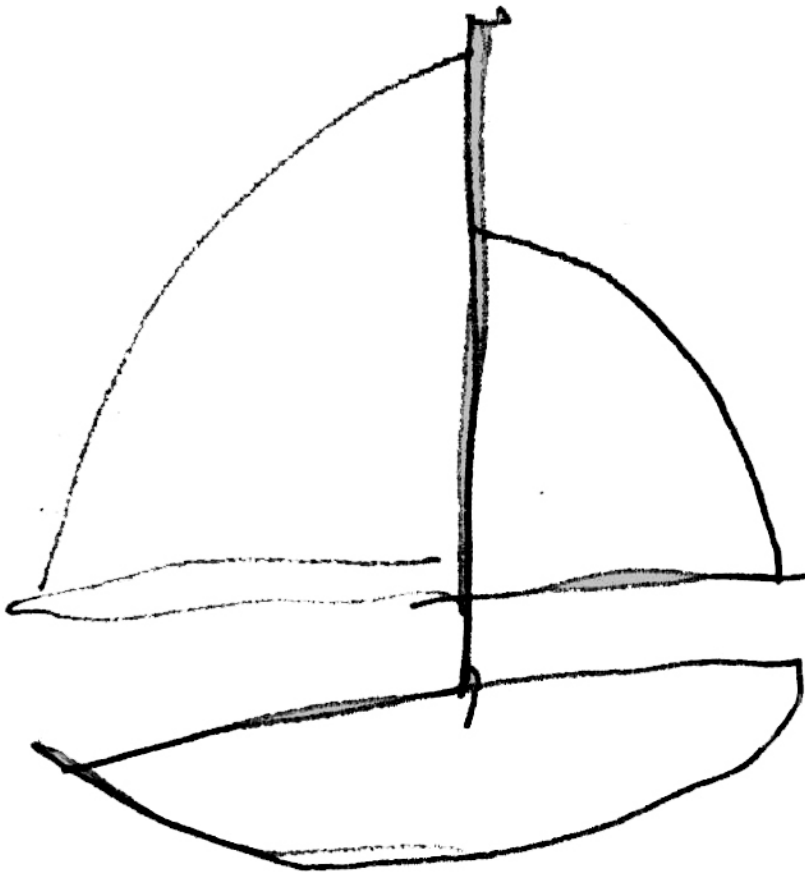


Perspectives

The Perspectives show what the building could look like in a more refined manner



New Orleans “Lifting Up”



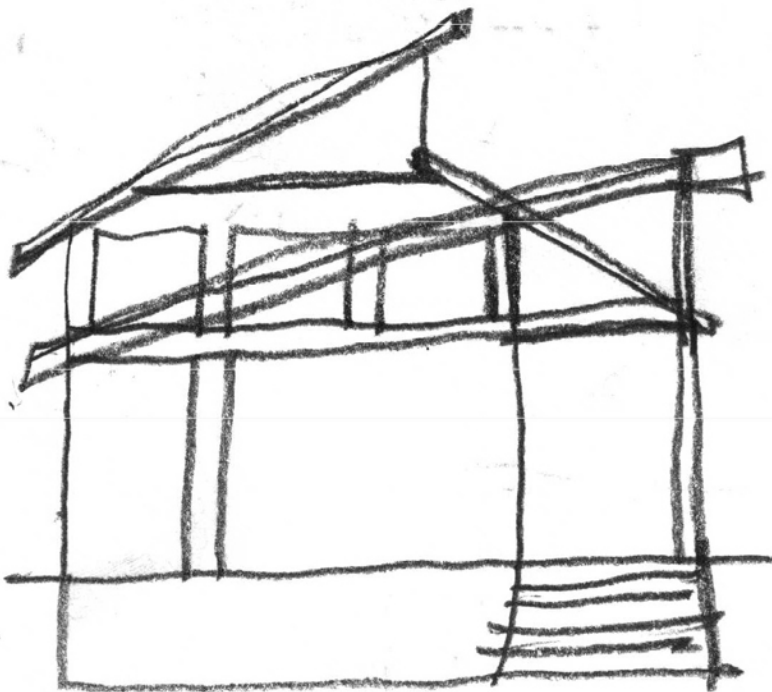
Initial Concept

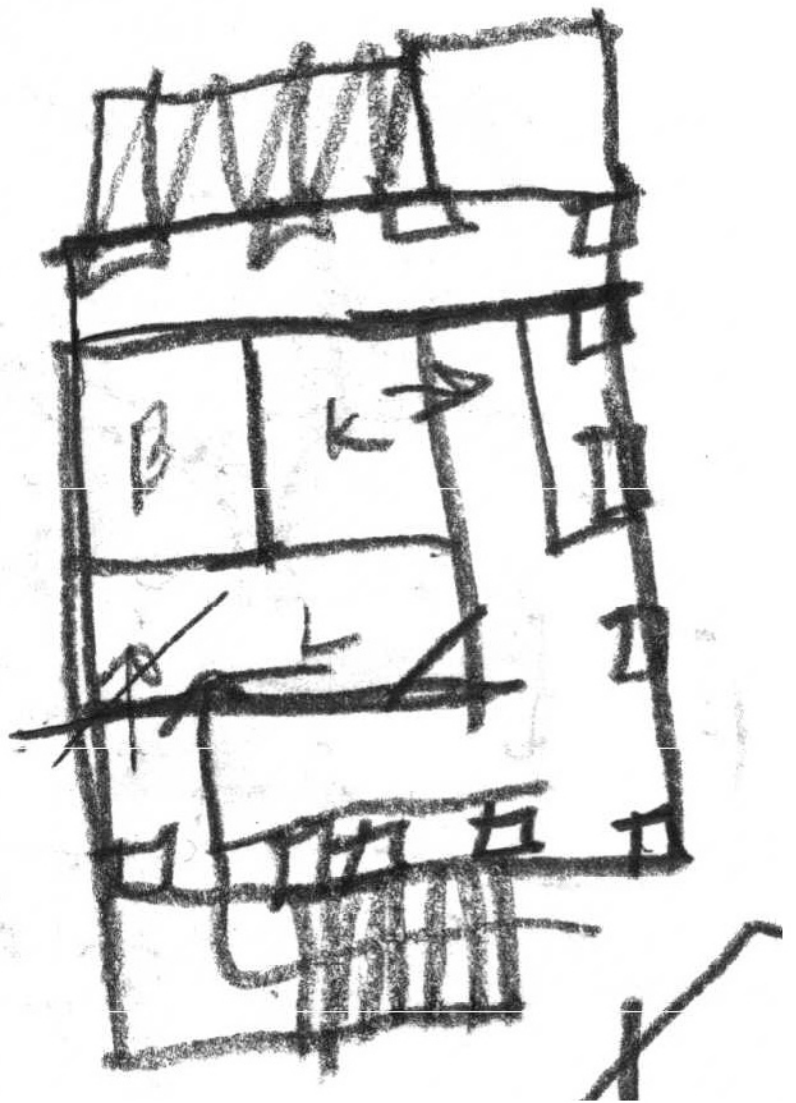
In this project the initial idea was how can one create a building that can withstand flash flooding but also blend into its environment?

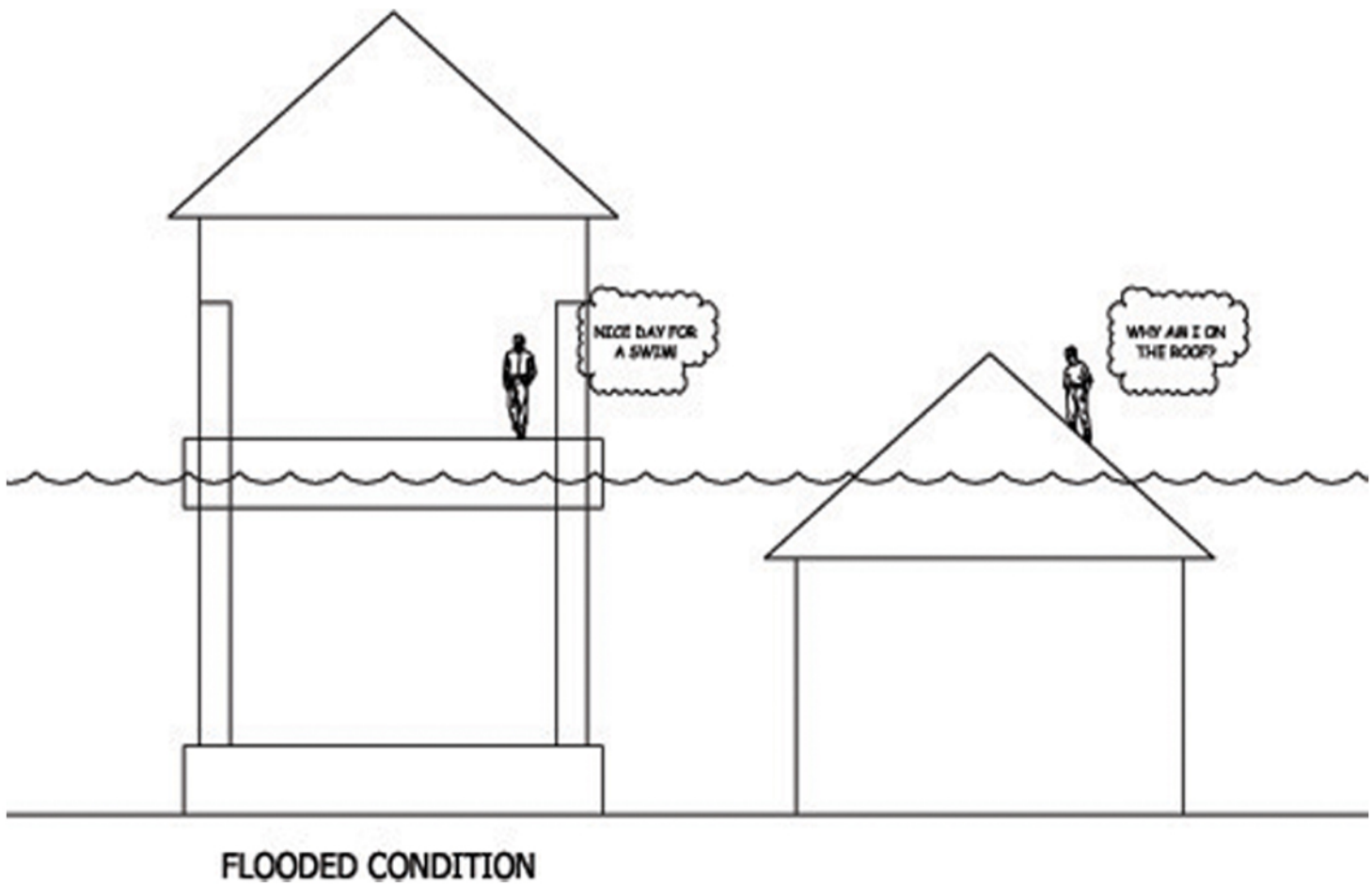
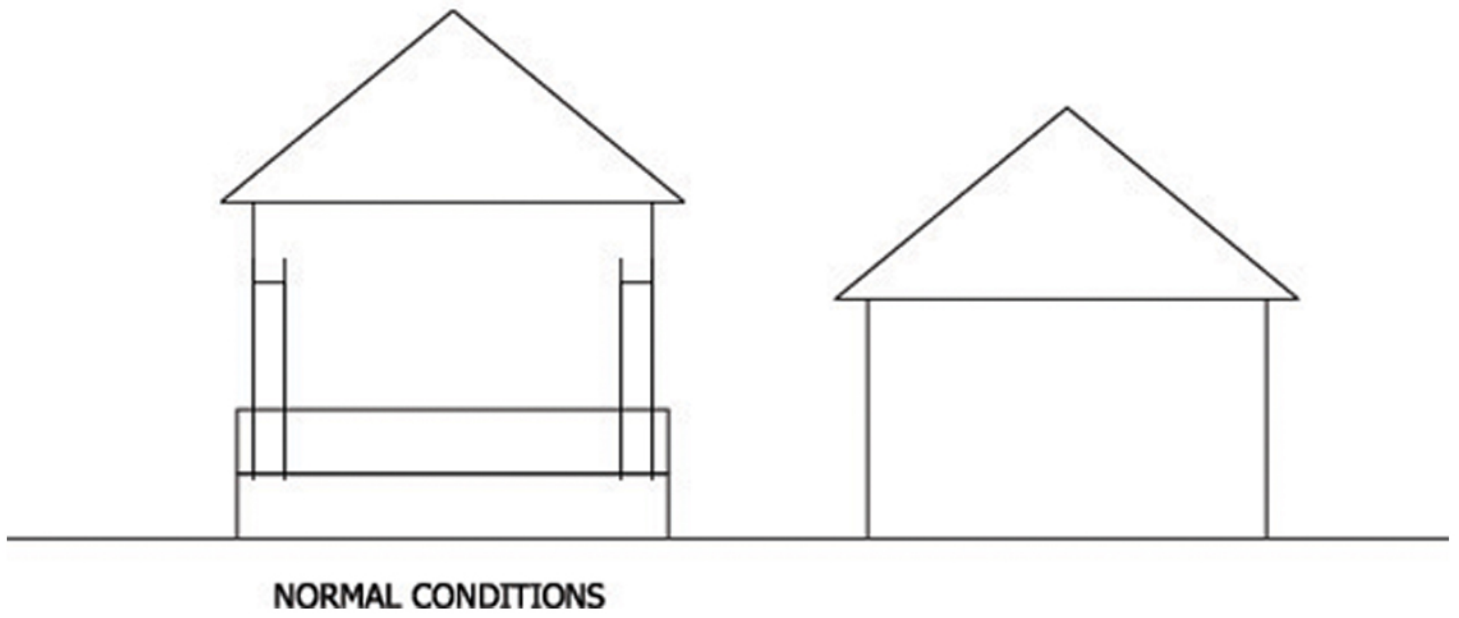
The first problem to deal with is how to make a building withstand a flash flood or in this case a levee breaking. The solution is make it float. With that established how do you make a building float like a boat and furthermore how do you create a building that doesn't look like a boat. Also if it doesn't look like a boat and doesn't act like a boat how do you make it float?

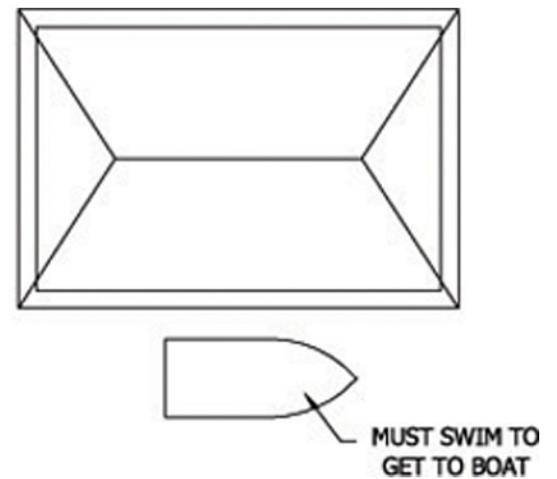
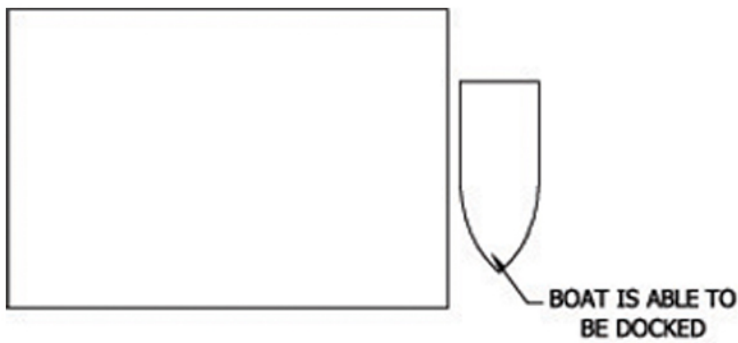
Also to what purpose can a house that floats facilitate to anyone who would own this type of a building and what help could it be to the surrounding area?

Another question is how do you keep the building in place once it is floating?









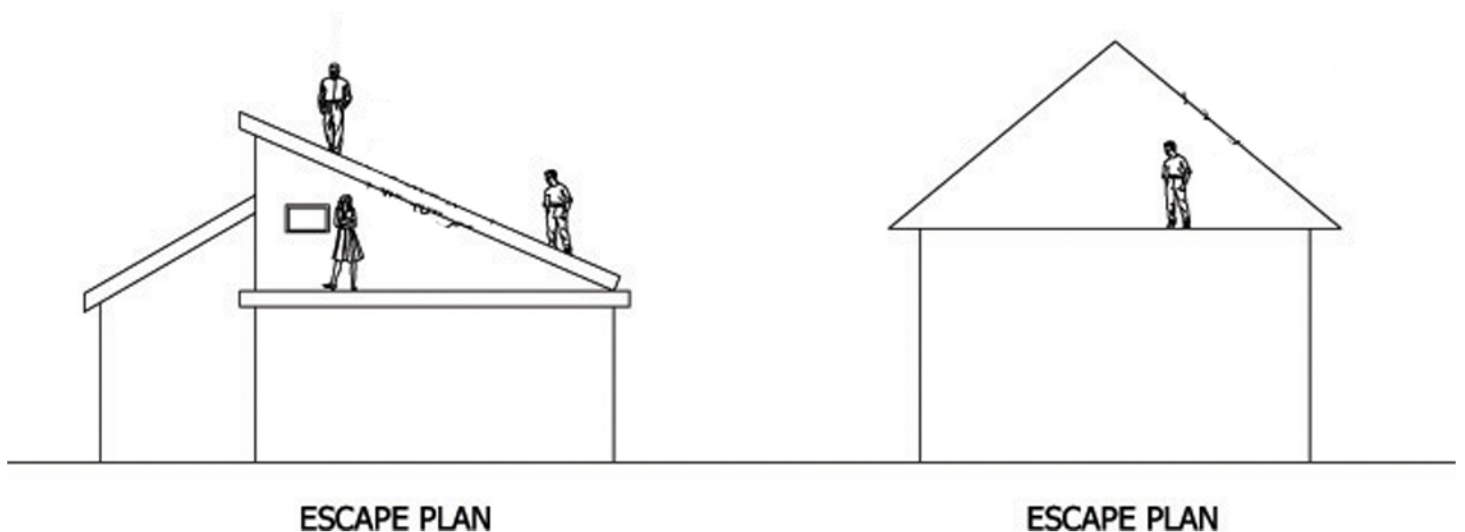
Solutions

For the first problem how do you make a building float I looked at various flotation systems so that I could determine how much buoyancy would be needed to make a building float. From that research I concluded that it would require two feet thick and twelve feet wide of flotation for every lineal foot of building foundation. I also determined that in order for the building to even begin to float it would require three feet of water underneath the building. So the solution to making it float was lift the bottom of the flotation up three feet and then the next two feet of building would be flotation for the building. And then including the structure it would put the finish floor height at six feet above the grade.

The next problem would then be how do you keep the building in place once it is floating. The solution to that is to integrate moorings into the building structure itself to help keep it stationary.

The third question is to what purpose does this serve. By creating this solution it helps protect the people and contents of the building from being damaged by water or weather. It also creates a place for other people to go to if they were driven from their homes. Finally it creates a place that would make rescuing people very easily.

Another question that might have come up is what happens if for some reason the building doesn't float what then? This is why a secondary exiting plan would be created so that people would not be trapped in an attic.





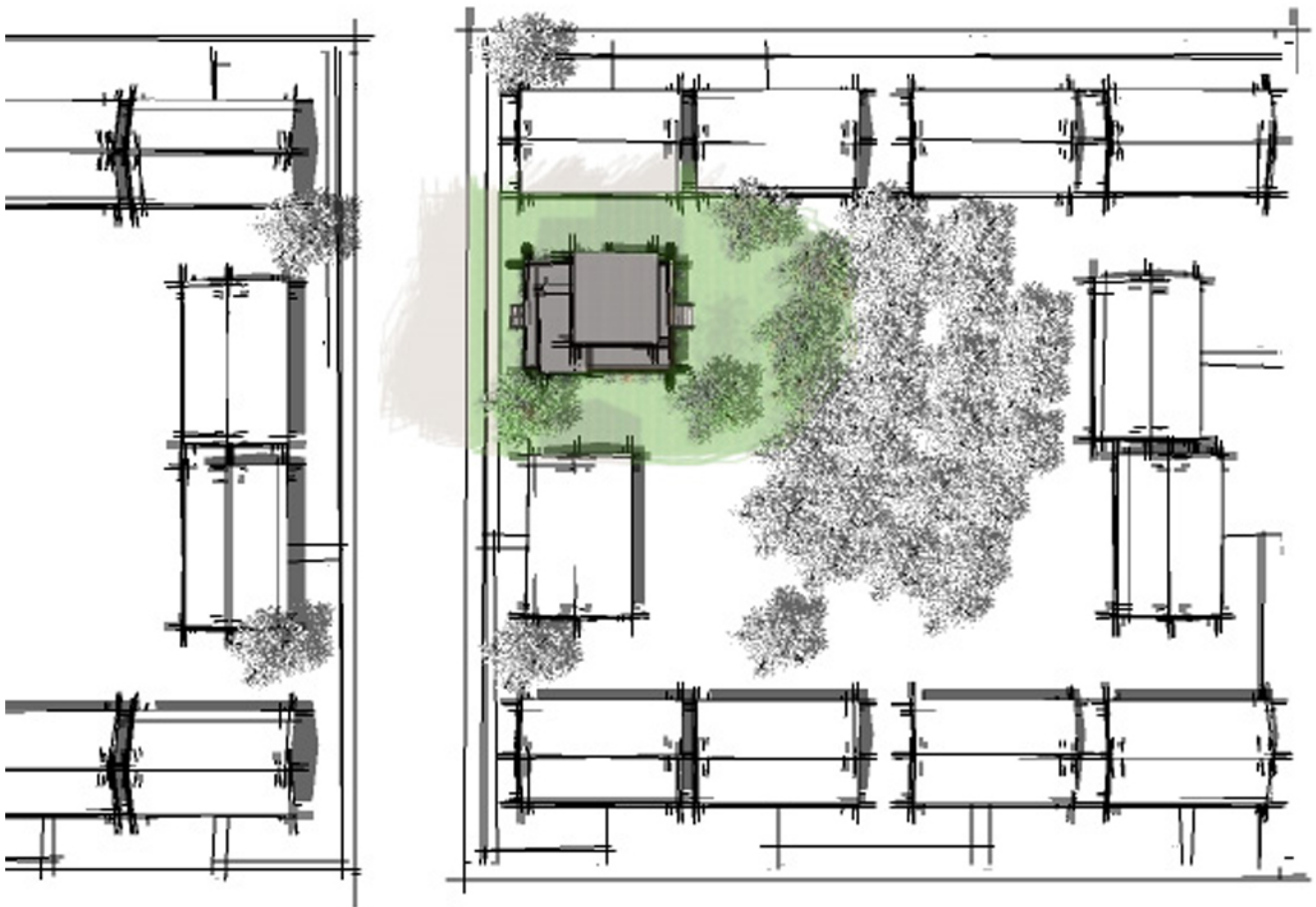
Site Selection

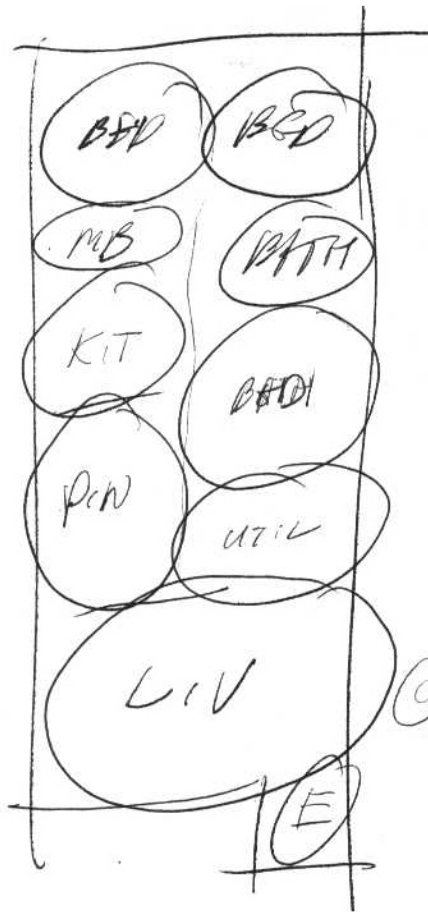
After finding solutions to the problems I found the next step was to select a site. Given that this situation just recently happened in New Orleans I choose that city for my location. With the city selected I then began searching the city for an appropriate site. The criteria I was looking for was an area where the water reached an adequate height to support a design that could float.

I approached locating this site threw various avenues that could tell me how high the water reached. From this search I came up with this location on the east side of the city right off of one of the canales.

The Site within the Location

After selecting a block within the city I then selected a lot within that block to place my building. This was not a very difficult task but necessary. From the data that I had I selected the site as shown in the site plan below. I selected this site because the water level reach around twelve feet in this location and it provided enough flooding to make the building function.

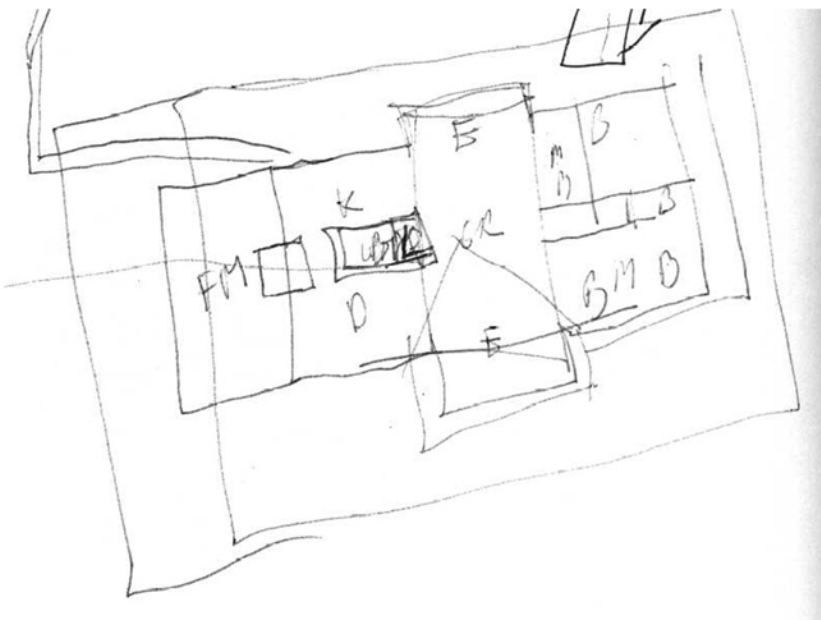




Initial Building Concept

After selecting the lot for the building I started to try to design the building in a way that would be balanced. My original concept was to create a building type that would have a deck that would surround the building so that a boat could dock at any point on the building. I also was trying to keep the building a single level. I tried to do this because I thought about creating a two story building that would have the first floor as a wash out and the second floor would float. This idea seemed to not be feasible due to the fact that the water level would most likely never reach the point where the second floor would actually float.

I then took the look of a river boat and tried to create a plan that would reflect that idea. I created two foyers on either side of the building that would represent the paddles of a river boat. I then took the front and rounded it to look like the front haul of the boat and then made the rear flat. After studying this for a while I decided to redesign.

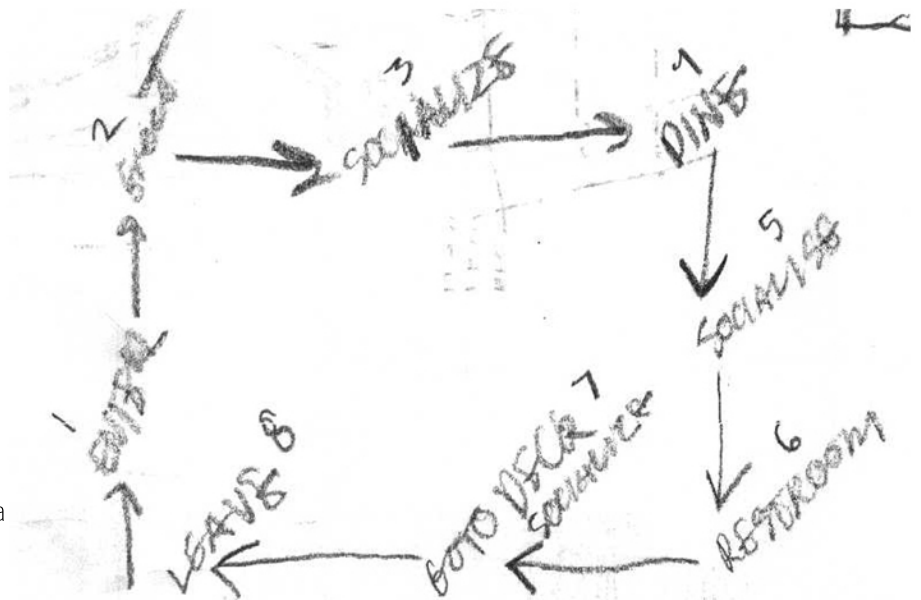
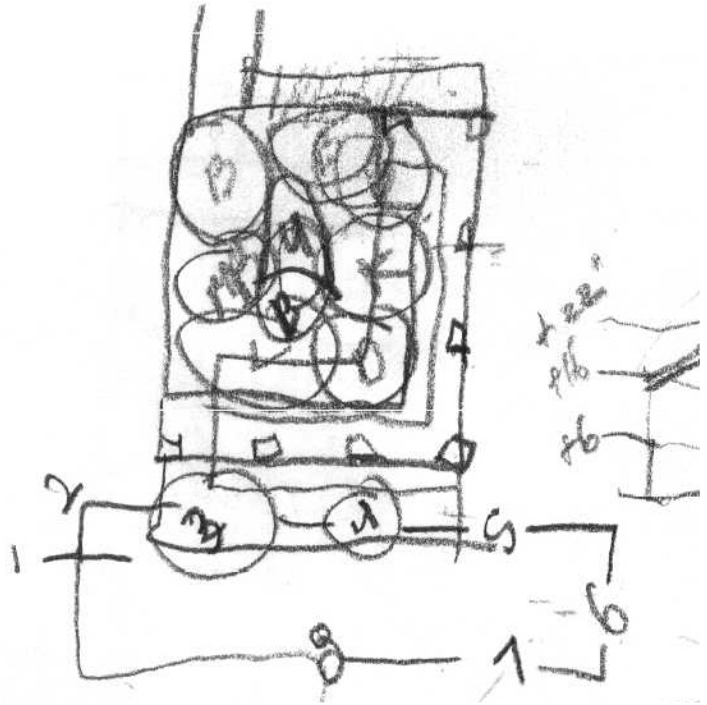


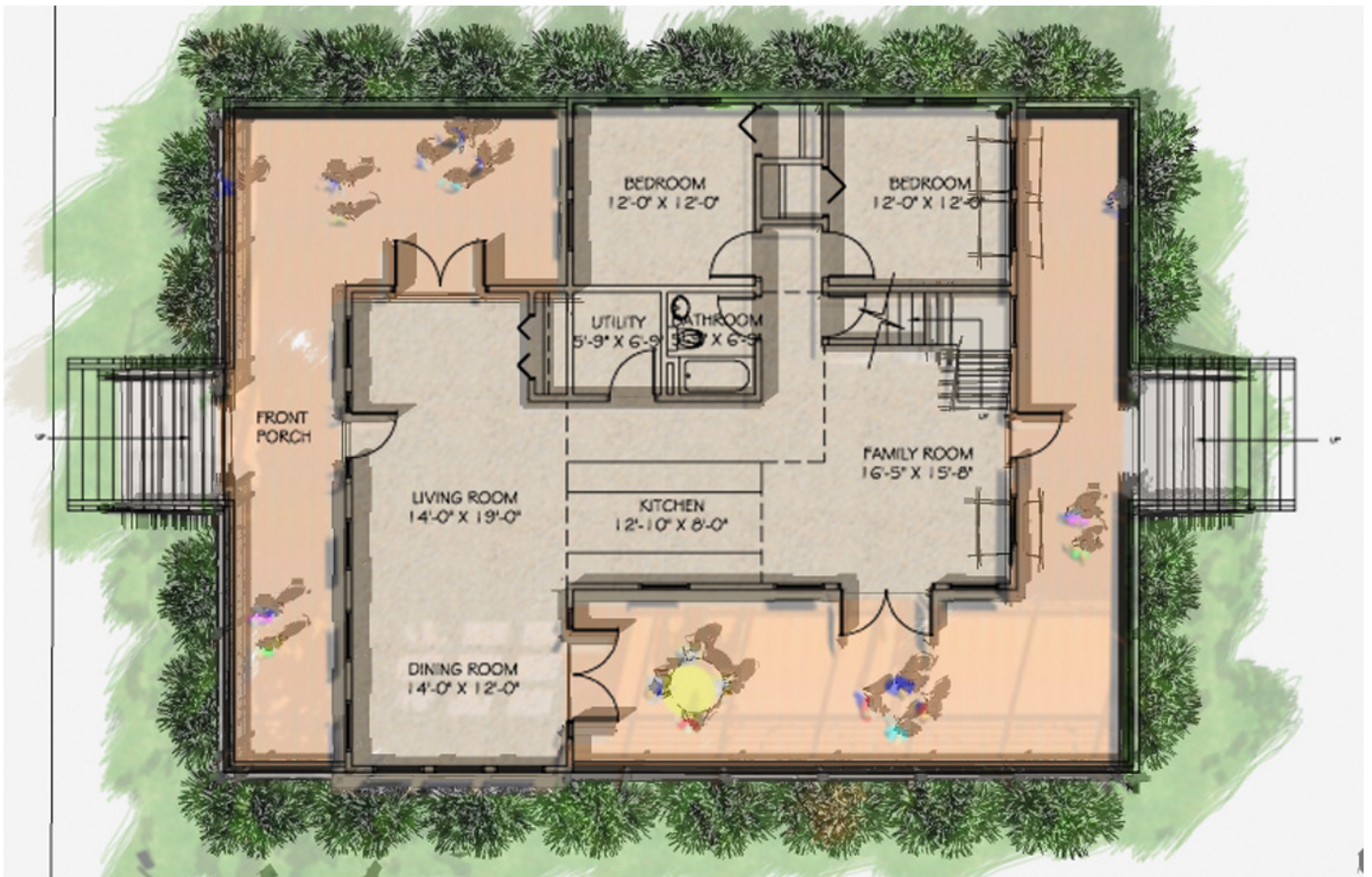
Final Concept

After looking at the initial concept I decided to revise my thinking. I started to look at pictures of New Orleans to try to figure out what gave the buildings there sense of place. After many days of analyzing the pictures I came to the conclusion that it was the porches. Also, the decorative railings on the porches that really stood out in most of the pictures that I studied.

From that research I then started to look at how the building would function. I created a list of rooms and in what order they may be used in. From there I started to integrate the porches into the plan. Next I started to think about how I could integrate the outside spaces on the porches in to the living areas of the house. I tried to make the porches extensions of the indoor spaces.

After I created a rough concept plan I then started to look at rough elevations of the building trying to determine how the building should look. From that point I roughed out a basic idea of a form for the building and started on the plans and elevations.





First Floor Plan

With the first floor I tried to create a more modern plan while keeping with the New Orleans building type. In this plan I placed the entry into the living room. The living room was connected to the front side porch by double doors that could open to give more space to the living room. By doing this I connected the outside area to the inside area of the living room.

Also connected to the living room is the dining room. I connected the dining room to the rear porch with another set of double doors. This was done so that the dining room could spill out onto the rear porch to create a connection and more space for larger parties if necessary.

The Kitchen is the central hub in the house. This room is connected to the living room, Dining room, and family room. This was done on purpose so that from any room in the house that people could be entertained would have easy access to the kitchen and for serving purposes. The family room and sleeping quarters were purposely placed in the rear of the house. This was done to keep the less formal spaces together and separated from the formal spaces.

Second Floor Plan

The second floor was created for two reasons. One reason was to have a place for the master bedroom and the office. The second reason was to create a secondary escape route in case of the floatation system failing. The windows in the loft space would be large enough for people to fit threw them and be able to get out of the building and on to the porch roof structure. From there they could make there way down the porch roof to the rear of the building and the climb up to the second story roof where they could be rescued.





Elevations

The look of the building is my interpretation of a New Orleans home. I tried to create the porches and railings with a more contemporary look to them. I also tried to fit the building shape to a more modern type as well.





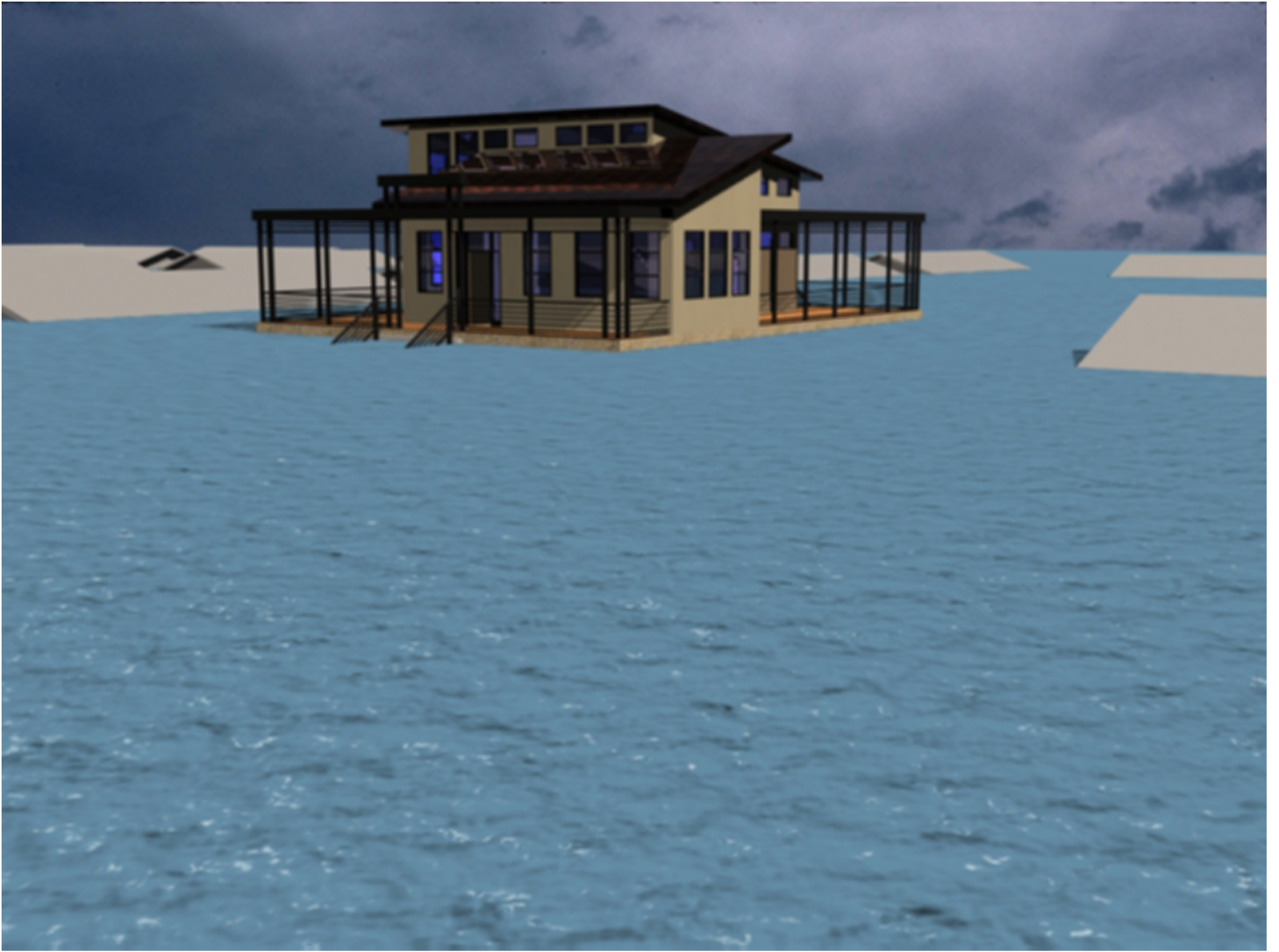
Perspectives

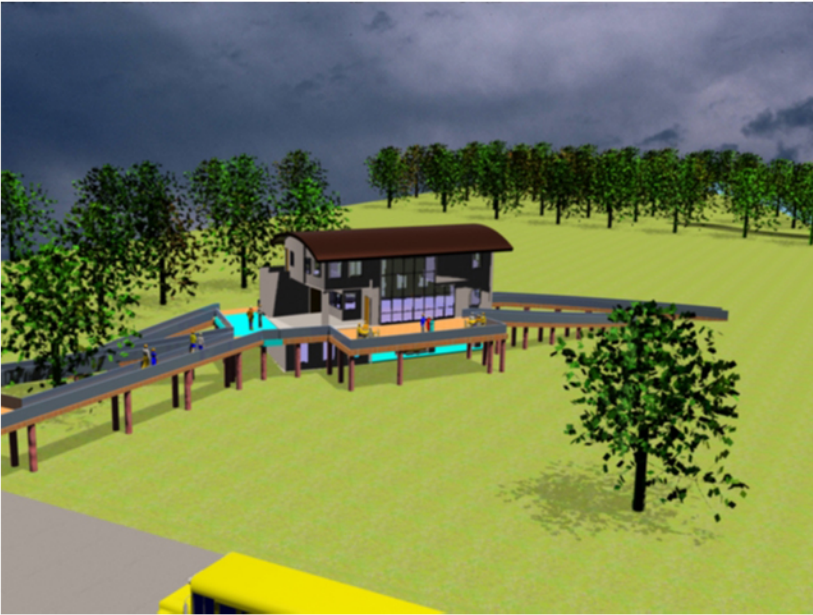
These images are provided to give a more refined look of the building

System In Action

The picture to the right is a perspective rendering of how the building system might work and look in the event of a levee break condition.



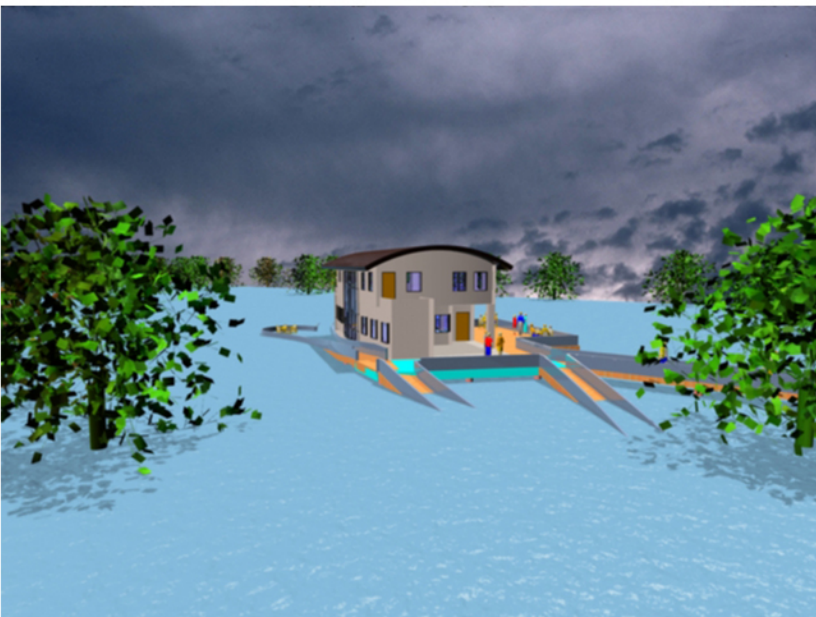




Indiana

In the Indiana scenario I would have liked to take it further by creating a integration between the site and the building. If I could have, I would have liked to create different areas in the landscape that would be accessible during the times of flooding that would help give the feeling of joy when a flood happened. In short I would have liked to create an area that would cause the occupants to want a flood to happen. This in turn would have turned a potentially horrible disaster into something to look forward to.

As for the final design of this project I created a building system that would react to its environment. The ramping system that I created served multiple purposes during times of flooding and times when there is no flooding. During the times that there is no flooding the ramps are used as pedestrian pathways to different parts of the site. During flooded times the ramps are used as boat docking points and different experiences at different levels of flooding.

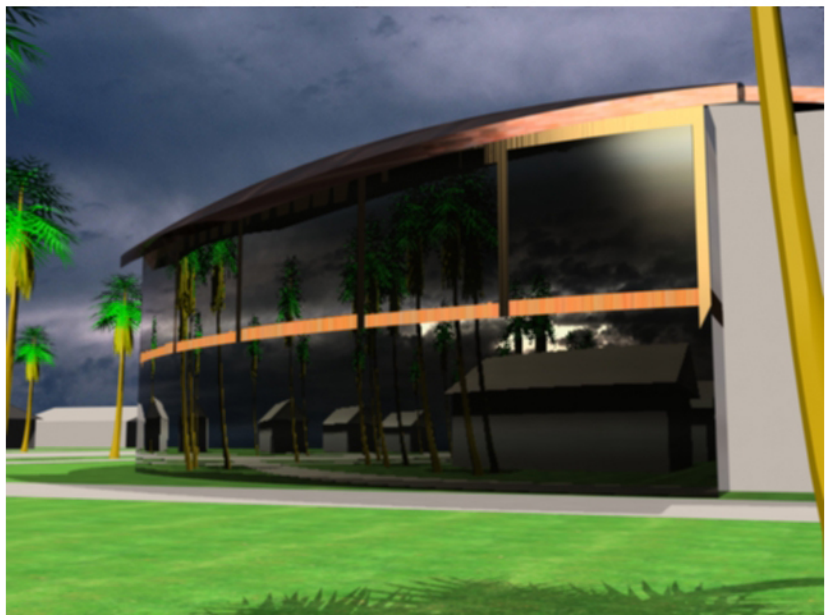




Florida

The Florida scenario I would have also liked to develop the site further. I wanted to try to integrate the indoor and outdoor spaces further and try to link the building shape to the site. This would have been done by continuing the form of the building into the landscape. I would have used gathering areas and landscaping objects to create this connection.

To reemphasize what was accomplished with this scenario, this project was created to develop a system that would create a second skin around the building. The system consisted of a shutter or shield system. This system would encapsulate the building during times of severe weather. The system itself was designed to create a second barrier between the building and the exterior elements so that the system would take the brunt of the severe weather and keep the interior safe. The building shape also was created to help deflect driving rain and flying debris.

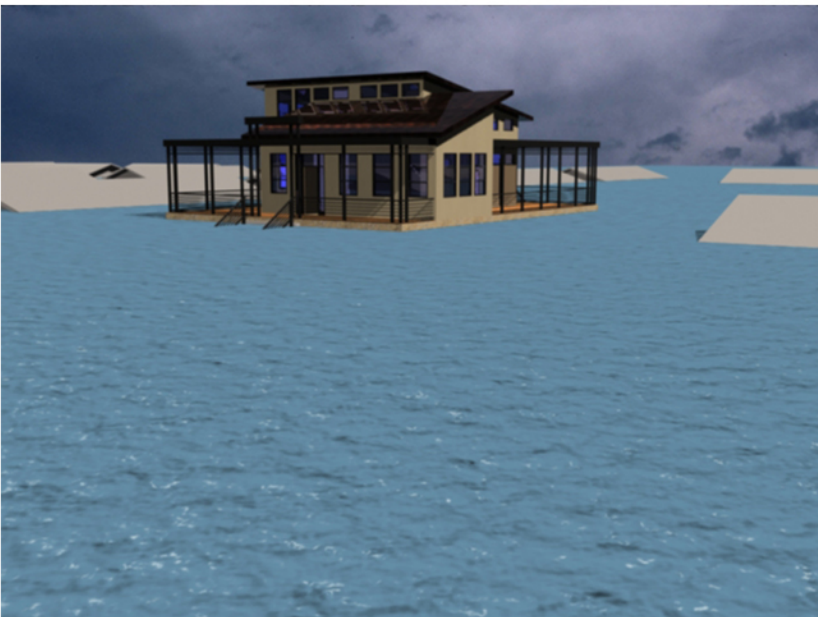




New Orleans

This scenario was the most successful of all three projects. This is because it was the most down to earth feel of them all. This project took into count the context of its surroundings and tried to capture the essence of the area it was placed into. It had a quality that can not really be expressed in words. But, as per the other two projects it could have been integrated into the site better.

This project created a flotation system that would carry the building up to a maximum height that would protect the occupants and belongings of the occupants. The system was created to carry the building up to stay level with the rising water around it. By doing this it helped to keep the occupants safe from drowning and being trapped in the building. It also aided in rescuing of neighbors and made it easier for rescue teams to get in and out of the building.



Final Conclusion

All three of these projects were developed to address a problem that really hasn't been seen as a problem. The problem that is addressed by these designs is; If things are going to be build in areas that are known to be hazardous, then why not create the buildings to react to that known hazard. By creating these three projects I created systems that could be a stepping stone to the creating of new building types in these areas.

For a final overview of this thesis the main solutions to each scenario are summed up in this statement. "Moving up, Closing up, Lifting up" (Harry Eggink). This statement perfectly describes these projects in there simplest forms. Indiana river flooding should "move up", Florida hurricane buildings should "close up", and New Orleans buildings should "lift up".

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